ALLEN'S HUMAN ANATOMY.

SECTION III.

MUSCLES AND FASCIÆ.

A SYSTEM OF

HUMAN ANATOMY.

INCLUDING ITS

MEDICAL AND SURGICAL RELATIONS.

BY

HARRISON ALLEN, M. D.,

PROFESSOR OF PHYSIOLOGY IN THE UNIVERSITY OF PENNSYLVANIA, ETC., ETC.

ILLUSTRATED WITH THREE HUNDRED AND EIGHTY FIGURES ON ONE HUNDRED AND NINE PLATES, MANY OF WHICH ARE BEAUTIFULLY COLORED. THE DRAWINGS BY HERMANN FABER, FROM DISSECTIONS BY THE AUTHOR. ALSO, UPWARDS OF TWO HUNDRED AND FIFTY WOODCUTS IN THE TEXT.

SECTION III.—MUSCLES AND FASCIÆ.

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PROSPECTUS

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WITH

A CHAPTER ON HISTOLOGY,

—BY—

E. O. SHAKESPEARE, M. D.,

OPHTHALMOLOGIST TO THE PHILADELPHIA HOSPITAL.

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The plan and scope of the work may be gathered from the following brief extract from the introduction.

"It is the design of this book to present the facts of human anatomy in the manner best suited to the requirements of the student and practitioner of medicine. The author believes that such a book is needed, inasmuch as no treatise, as far as he knows, contains, in addition to the text descriptive of the subject, a systematic presentation of such anatomical facts as can be applied to practice.

A book which will be at once accurate in statement and concise in terms; which will be an acceptable expression of the present state of the science of anatomy; which will exclude nothing that can be made applicable to the medical art, and which will thus embrace all of surgical importance, while omitting nothing of value to clinical medicine,—would appear to have an excuse for existence in a country where most surgeons are general practitioners, and where there are few general practitioners who have no interest in surgery."

As a brief introduction to the essential features of the volume, attention is invited to the kinds of knowledge of the human body which the physician demands.

First. An exact acquaintance with the form and construction of the organs of the body. But, inasmuch as an anatomical fact is of little use unless the range of application of the fact is known, the due connection between the normal condition of the organs and their variations within the limits of health will receive proper attention, accordingly the typical description of each organ will be followed by a brief statement of such variations.

Second. The physician demands a knowledge of the relations of the parts. This information it is necessary to possess in performing operations and in explaining signs and symptoms.

Third. The physician needs some account of the uses of the organs. This subject overlaps physiological anatomy. That much only will be succinctly given as may be said properly to illustrate the subject from an anatomical point of view, and at the same time be free from controversy.

Fourth. The physician must have a true conception of the nature and general behavior of morbid processes, and of the manner in which such processes are modified by locality. His comprehension of the changes due to diseased action in a given place must be fairly proportional to his knowledge of the normal anatomy of that place. This subject, which will receive the name of *localization of diseased action*, will be illustrated for the most part by concise statements of recorded cases, in which the essential feature of each case will be emphasized, and the bearing it has on the subject treated of clearly shown. In presenting anatomical features in explanation of given lesions, or of signs or symptoms, care has been taken to give the sources of the statements made.

"Among other matters, the book will be found to contain an elaborate description of the tissues; an account of the normal development of the body; a section on the nature and varieties of monstrosities; a section on the method of conducting post-mortem examinations; and a section on the study of the superficies of the body taken as a guide to the position of the deeper structures. These will appear in their appropriate places, duly subordinated to the design of presenting a text essentially anatomical."

In the preparation of this elaborate work no pains have been spared. The illustrations of normal anatomy, with a few exceptions, are from original dissections, engraved on the stone, with the name of every part clearly drawn upon the figure after the manner of "Holden" and "Gray," and in every typographical detail it has been the effort of the publishers to render the volume worthy of the distinguished position anticipated for it.

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HENRY C. LEA'S SON & CO., PHILADELPHIA.

ALLEN'S

HUMAN ANATOMY.

MUSCLES AND FASCIÆ.

CONTENTS.

THE MUSCLES AND FASCIÆ.

THE MUSCLES AND FASCIÆ.

GENERAL CONSIDERATIONS.

MUSCLES.

Muscles are the principal organs of locomotion, and are of two kinds, the *voluntary*, which are under the control of the will, and the *involuntary*, which are not. Examples of the first are the muscles of the trunk and limbs; examples of the second are the muscular layers in the walls of the intestinal canal and bloodvessels, including the heart. An imperfectly defined group, the *semi-involuntary muscles*, are thought to be represented in the diaphragm, in the pharynx, and in the lower portion of the rectum. The involuntary muscles are not described in this section, but will be found in the accounts of the viscera and the bloodvessel system.

Myology is the technical word employed to include all subjects relating to the description and properties of muscle.

The Properties of Muscles. The most important of these is contractility. In the voluntary muscles the contractions are followed by intervals of repose. By *muscular tonicity* is implied a state of passive activity that is constantly present during the conscious state. It is illustrated in the manner by which the elevators of the lower jaw act in maintaining contact between the upper and lower teeth even when these muscles are not being influenced by the will. W. Adams happily describes muscular tonicity as a state of vigilant repose.

An abnormal phase of tonicity is met with when a muscle sustains undûly prolonged action of its fibres; under these circumstances a shortening of its belly takes place, which persists as long as the cause of the contraction is maintained. Such abnormal modification of contraction is termed *contracture*.

Contracture of muscle, according to Billroth, is due to disease of the muscles, to primary disease of the nervous system, to loss of antagonism, as well as to the excessive use of one set of muscles over another. Barwell has found that a muscle, owing to its *elasticity*, can be stretched to a distance equal to half of its own length when at rest, but when shortened to a distance in excess of one-fifth of its length, it will be thrown into wavy curves. Stretching of a contractured muscle is readily accomplished and maintained, provided the cause for the contracture be removed. Contracture, clinically considered, is a subject of great importance. In psoas abscess the psoas muscle is contractured, and the thigh is slightly flexed on the pelvis. In lateral curvature of the spine, contracture of the muscles will take place on the side of least curvature. Congenital dislocation of the hip in the same way will excite contracture of the gluteal muscles. Coxalgia will excite contracture of the femoral muscles, etc.

Muscles yield readily to pressure, as from an aneurism or abscess, and easily become infiltrated with the products of inflammation. In caries and necrosis the muscles in connection with the diseased bone undergo atrophy. Any cause of disuse, such as forced inaction, paralysis, etc., will cause muscular atrophy and fatty degeneration.

Muscular tissue is easily affected by conditions of habit and state of health. The terms "strength" and "debility," as ordinarily used, express the degree of the systemic strength or weakness. As judicious use of the muscles causes in them an increase in size, so excessive use or inaction is followed by their decrease in size. Of the complications following local injury, enforced disuse or rest of the muscles is perhaps the most annoying. The muscular fibres become reduced in volume and efficiency, and the synovial fluid both in the joints and along the sheaths of the tendons becomes scanty. After the primary effects of the lesion have disappeared, those created in the muscles will persist.

The Shapes of Muscles. The simplest form of a muscle is that of a *lamina* or *ring*. In either case the muscle is fleshy throughout, and little or no difference is detected between the points of origin and insertion. Diversity in voluntary muscles is established by division of the single lamina into separate thongs or fascicles, and by the variety exhibited in the attachment of these to adjacent parts by means of fibrous sheets or bands. In the involuntary or semivoluntary muscles diversity occurs by the circular fibres about a tube, such as the intestine, becoming spiral or even longitudinal. The change which either a lamina or a ring undergoes in furnishing the patterns for forms more complex than themselves, is said to be the result of its *specialization* or *differentiation*, these terms being used interchangeably.

In those muscles which have been formed by differentiation from laminæ a tendency exists for one or more such fascicles to remain imperfectly separated from the main sheet. When a muscle has two points of origin and but one of insertion, one of the slips of origin is said to be an attempt at the formation of a distinct muscle. Thus, in the Biceps Flexor Cubiti the scapular and the coracoid heads are liable to become distinct, and thus the chief variation seen in the muscle completes the division hinted at by the presence of the second head. This tendency has been formulated under the name of the law of Meckel, which in substance is as follows: The presence of more than one head to a muscle is an indication that such accessory head is in reality the beginning of a process of differentiation of a distinct muscle.

Variations of muscular forms are confined to the following kinds: Variations due to excessive differentiation. Variations in defect or excess. *Cleavage*, by which term is meant a division of a muscular lamina or set of laminæ either longitudinally or transversely. In the former instance the cleavage is parallel to the course of the fibres. In the latter instance it is parallel to the plane of the lamina, and is often spoken of as *planal*. Variations due to imperfect differentiation. *Fusion*, a term of convenience, used here to indicate that two muscles conventionally distinct have united in whole or in part. Compensatory variations, by which one muscle takes the place of another in whole or in part. A muscular bundle arising from one muscle to be inserted in another is said to send to such muscle an *accessory slip;* one receiving a fascicle from another is said to receive a *slip of contribution.*

When a muscle is highly specialized, and fibrous bands connect it to its origin and insertion, the muscular mass is called its *body* or *belly*, and the fibrous bands the *tendon of origin* and the *tendon of insertion* respectively.

The tendon of origin as well as of insertion often passes a variable distance within the belly, and is thus concealed; or it may be displayed upon the surface of the muscle. In either case the fibrous tissue is greatly thinned, and is lost upon the sheath.

Nomenclature of Muscles. When a narrow tendon receives oblique fasciculi upon one side only, such a muscle is called *penniform.*—When the edge of a concealed tendon becomes apparent between divisions of a belly composed of oblique fascicles, such a muscle is called *bi-penniform.*—When a concealed tendon becomes apparent at right angles to the longitudinal axis of the muscle such a muscle is said to possess an "inscription." Some muscles of the body tend to be twisted upon themselves near their insertions. Such a disposition is called *torsion.*—When a tendon is long or well pronounced its action is not necessarily in a straight line with the longitudinal axis of the belly, but may be influenced by angulation about a resisting bony surface. Such muscles are called *trochlear* or *pulley muscles.* The pulley form is not confined to the muscles ordinarily termed trochlear. Many muscles, such as the Obturator Internus, are at all times trochlear, the posterior border of the ascending ramus of the ischium representing the pulley. Other muscles which may be straight in one position will be trochlear in another, as, for example, the Iliacus Internus and the Psoas Magnus, which, while straight in the position of rest, become trochlear when the lower limb is thrown backward, as in running. In the act of swinging the lower limb forward and inward these muscles are again trochlear as far as they are involved. Many trochlear forms are thus temporarily established by bone, and even by sheaths surrounding tendons, bands of fascia, etc.

In addition to the arrangement of muscles according to this degree of complexity, or the manner of their fasciculation, or of the formation of their tendons, they are susceptible of classification by their positions relative to the skin. In this sense the terms *superficial* and *deep* muscles are employed. Superficial muscles embrace all the subdivisions of the great subcutaneous muscle (Panniculus Carnosus), which is well developed in many animals such as the hedgehog and the seal, and of which the little muscles moving the outer ear—the muscles of expression—the Platysma Myoides, etc., are rudiments. The former of these are, as a rule, longer, and possess

more contractile fibres relatively to their size than the deep-seated ones.

Other modifications of a topographical arrangement are implied in the use of such terms as *intrinsic* and *extrinsic*. The Biceps Flexor Cubiti is an intrinsic muscle of the superior extremity; while the Pectoralis Major is an extrinsic muscle, since, notwithstanding its insertion into the superior extremity, it secures its origin from the thorax.

Muscular masses may have a broad origin and a small insertion, such as the Temporal muscle and the Latissimus Dorsi; or they may have a small origin and a large surface of insertion, as the Adductor Magnus; or they may have origins and insertions of nearly equal proportions, as the Masseter.

When a muscle lies above the axis either of the trunk or of a limb it is said to be *epi-axial*, and when below it, *hypo-axial*.

The study of the development of a limb is essential to a correct understanding of the nomenclature of muscles, and of their plan of arrangement. A limb in its earliest expression is a growth from the sides of the body. It projects at the distal end; while the proximal end aids more or less in making up the contour of the trunk. The limb at first carries with it the muscular laminæ of the trunk, but soon the hand or the foot projects through the laminæ, and in the adult state the muscles passing from the body to the limb represent the remnants of the general trunkal layer, as modified by the presence of the limb. The most instructive muscle of this group is the Latissimus Dorsi. In mammals this muscle has points of insertion along the anterior extremity from the bicipital ridge of the humerus to the carpus.

In short-limbed animals there is a tendency for the muscles of the extrinsic group to pass further along the extremity than in the long-limbed animals.

The human subject will sometimes exhibit the extremities in an aborted or imperfect form. In these examples the extrinsic muscles advance further toward the distal end of the limb than is normal.

The Functions of Muscles.—Muscles in the form of specialized circular bands are called *sphincters*. They serve to constrict the tube about which they occur. They are placed at the orifices of tubes, or separate one compartment of a common canal from another. There is usually no muscle antagonistic to a sphincter. When the constricting action is suspended the muscle is said to be relaxed and the orifice to be *dilated*, or *inhibited*.

Muscles are named flexors, extensors, abductors, and adductors, as they influence the joints near which they are placed. *Pronation* is a form of modified flexion. *Supination* is a form of modified extension. Abduction and extension do not essentially differ, nor do adduction and flexion. *Rotation* is a form of adduction or abduction according to the line of traction of the rotating muscles.

Muscles, dilating orifices not guarded by sphincters, are often called *dilators*. Other terms in common use, such as elevators, depressors, etc., do not demand special definitions. The flexors are as a rule stronger than the extensors; they are apt to act more independently, and are less compact in form.

A muscle is powerful in proportion to the number of the fasciculi of which it is composed. The disposition of the fasciculi varies in muscles, and, as stated above, the shapes of the muscles are in great measure determined by this disposition.

Muscles in which the fasciculi are straight, *i. e.*, parallel to the line of the tendon of insertion, are weaker, and move more slowly than do those in which they are arranged obliquely to the line of the tendon. At the same time the oblique fasciculi shorten the muscle more than the straight fasciculi, and require less effort to approximate the points of origin and insertion.

Assuming that both the flexor and the extensor muscles are preserving their tonicity, it follows that the contraction of the muscles of either set must exert a force sufficient to elongate the opposing muscles, as well as to lift the weight of the portion of the limb on which they are inserted. The flexors of the leg, for example, not only exert a degree of force sufficient to raise the bones of the leg and the foot, but must overcome the force exerted by the tonicity of the muscles that extend the leg. This force is known as the antagonistic force, and acts as a check to the degree of contraction of the active set. When this force is withdrawn, either by paralysis or section of the tendon, undue action is at once manifested in the opponents. Some writers describe the muscles opposed to the contracting ones as being relaxed to a degree in exact proportion to the amount of movement in the contracting group.

Muscles in certain positions are said to have ligamentous functions. Their tendons, while crossing joints, will assume to the joint surfaces the character of accessory ligaments, and may be said to differ in function from the intrinsic ligaments of the joint only in being influenced by muscular action. Even when not crossing the joints, but when inserted in or about them, tendons are intimately associated with the

disposition and function of joint surfaces. The shoulder-joints and the knee-joints especially illustrate these statements.

The section on the general consideration of the bones embraces a paragraph on the influence exerted by the muscular system upon the shapes of bones.

The muscles of the subject are usually no longer soft and extensible, but are firm and brittle, either from rigor mortis or from the nature of the preservative agent employed. Careless handling of the subject often lacerates the more tender muscles, as the Psoas Magnus and the Semimembranosus. Care should be taken in studying such material that erroneous conceptions of function be not entertained.[1]

The Number of the Muscles.—The number of muscles in the body, excluding those belonging to the bloodvessel system and alimentary canal, is 229.

They are arranged as follows:—

Muscles of the vertebral column and trunk	51
Muscles of the neck (exclusive of those of the vertebral column)	24
Muscles of the head	37
Muscles of the limbs	117
Upper limb	58
Lower limb	59

The Nerves and Bloodvessels of Muscles.—Muscles are vascular, and, as a rule, abundantly supplied with nerves. Ruge attaches great importance to the manner of nerve termination in muscle. He sees in the pad of protoplasm (see p. 83) evidence in favor of the hypothesis that each muscle is an aggregation of differentiated organs developed about the ends of nerves. From this point of view the study of such terminations becomes a matter of great morphological interest.

[1] According to H. Morris (Med. Chir. Trans., xl. 169), in dislocation of the hip on the dorsum of the ilium, induced after death, the Pectineus, Quadratus Femoris, and Obturator Externus muscles are quite constantly ruptured; the Gemellus Inferior, the Obturator Internus, the Adductor Longus and Adductor Brevis, Pyriformis, Obturator Internus, and the Gluteus Medius less frequently, the last three, indeed, very rarely. How different is this statement from that of Gross (System of Surgery, ii. 95), who says, "the two Obturators, Geminal, Quadratus Femoris, and Pyriform muscles are greatly stretched, and sometimes even partially ruptured." On the other hand, F. S. Eve (Med. Chir. Trans., lxii. 51) found by actual dissection that the only muscles that are apt to be ruptured by this dislocation occurring during life are the Gemelli and the Pyriformis. It is in every way likely that the effects described by Morris were greatly exaggerated by the post-mortem changes in the muscles; it is also conceivable—nay, more than this, it is sufficiently probable to make the observer cautious—that the rough handling of the cadaver which has been the subject of unreduced dislocation may cause rupture in muscles already over-tense and in a state of rigor mortis, and that the defection of such ruptures should be accredited to the primal effects of the displacement. How can ante-mortem rupture be distinguished from post-mortem? As a rule easily, viz., by the presence of blood-clot or blood-infiltration in the former instance, and its absence in the latter.

A CLASSIFICATION OF MUSCLES.

1. The muscles of the Head, Neck, Trunk, and Limbs—
   - I. The Muscles of the Head.
   - II. The Muscles of the Neck.
   - III. The Muscles of the Trunk.
   - IV. The Muscles of the Superior Extremity.
   - V. The Muscles of the Inferior Extremity.
2. The Muscles of the Alimentary Canal—
   - I. The Muscles of the Pharynx.
   - II. The Muscles of the Anal Region.
3. The Muscles of the Larynx.
4. The Muscles of the Genital Apparatus—
   - I. The Muscles of the Male.
   - II. The Muscles of the Female.

FASCIA.

The term fascia is given to a thin sheet of fibrous or connective tissue which is ordinarily appended to the muscular system or to the general integument, and which serves in the limbs as sheaths to muscles, or as a surface for muscular attachment, and in the cavities of the body for the general protection of the viscera. The fasciæ of the limbs and of the parietes of the trunk are divided into the superficial and the deep.

The *superficial fascia* is subcutaneous, and more or less intimately associated with the skin by means of delicate bands or trabeculæ. In some regions, as at the groin, several layers of this fascia can be demonstrated. Frequently loaded in health with adipose tissue, as at the buttock or on general limb-surfaces, it may also be without fat, as in the eyelids and the scrotum. The fasciæ are absent in the face and the scalp. In the former region the subcutaneous fat is not divisible into layers, the Buccinator muscle alone among all the facial muscles having a fascia-like covering.

The superficial fascia and the fat form together with the skin an envelope of the limbs of variable thickness, which, excepting at the joints, enables considerable motion to take place between the superficial and the deep fasciæ. In emaciated subjects the fat of this layer is absorbed, when the skin forms wrinkles or hangs in folds.

The *deep fascia* gives shape to the limbs, furnishes

points of attachment to muscles, and often determines the lines of their traction. It aids in forming intermuscular bands as in the Digastric muscle, or intermuscular sheets as in the Occipito Frontalis. It sends slips of attachment to strengthen the tendons of muscles, as in the Biceps Flexor Cubiti and the Latissimus Dorsi, and also gives definition, as in the thigh and the neck, to canals for bloodvessels and nerves.

Slips of fascia are often of importance in ascertaining the significance of muscular variations. Thus the internal brachial ligament (*q. v.*) is a fold of deep fascia which represents a muscular tract in some of the quadrupeds, and which may even become so in man.

The transition of folds of deep fascia into ligaments is evident in the neighborhood of joints, the capsules of which are thus strengthened. Examples of such fascia-like extensions are seen passing from the tendons of the muscles about the hip-joint to its capsule.

Belonging to the group of the deep fascia is a loose connective tissue layer lying between the parietal peritoneum and the adjacent parts. It is properly a sub-peritoneal connective tissue, and communicates with the thigh at about the insertion of the Psoas Magnus, with the hip-joint through the bursa iliaca, and with the buttock through the ischiatic foramen. Above it constitutes the retro-peritoneal space. A very useful method of studying this fascia in connection with the behavior of a quantity of pus lying within it is to inject the sub-peritoneal space with water, as recommended by Koenig.[1]

The following terms are used in describing fasciæ: The envelope of a muscle is called its *sheath*.—The sheath of a tendon is called its *theca* or *vagina*.—Under the name of *retinacula* are described bundles of fascia pertaining to the ligaments. They aid in determining the lines of traction of important muscles. The posterior portion of the capsule of the knee-joint exhibits two examples of the retinaculum. One of these extends from the head of the fibula to the capsular ligament, and assists the Popliteus muscle in maintaining traction upon the last-named structure. A second example of a retinaculum is seen where the oblique band of the same ligament receives some of the fibres of insertion of the Semimembranosus muscle.—A layer of fascia having a well-defined broad surface of attachment, especially when readily demonstrable, is called an *aponeurosis*. This term is restricted to a sheet of deep fascia which is set apart for a special use, and which is ordinarily accessory to muscular action.—A layer of fascia placed between two or more muscles, and affording points of attachment for them, is called an *intermuscular septum*.

A synovial chamber yields a glairy fluid called synovia, whose function in the fasciæ is to prevent friction, as between a tendon and its sheath. When it is in the form of a rounded sac, lodged between two opposed muscular or tendinous surfaces, the synovial chamber is called a *bursa*. The membranes forming the sheaths of tendons, according to Brodie, have the same structure as have those of other bursæ (the bursæ proper of Bichat), and cannot be distinguished from them.

Fascial bands assist in strengthening joints, when they are termed ligaments; such as the annular ligament of the wrist-joint. In this way they often act as pulleys to adjacent muscles.

Fascia, like all forms of fibrous and connective tissue, shrink when not in use. When muscles lose in volume the sheaths shrink, and when they gain the sheaths enlarge to accommodate them. The sheaths, however, cannot follow the muscles beyond a certain point. Hence the feebleness of an emaciated person; this feebleness arises not only from the loss of muscular force, but from the inability to economize muscular force by the aid of the opposed sheaths.

Long-continued malposition of a part may gradually induce shortening and shrinkage of fibrous tissue. The plantar fascia thus shortens in club-foot. Some curious examples of shrinkage are met with in the palmar fascia, which in elderly persons will sometimes end in marked deformities through forced flexion of the fingers. The fascia lata shortens in limbs in which the thigh has been for a long time flexed, and it can always be felt, in the emaciated, as a cord-like band extending downward from the crest of the ilium.

A layer of fascia is frequently a means of influencing morbid processes, either fixing them by anatomical limitation, or furnishing them the means of extending from one region to another. Fascia in the form of an intermuscular septum may act as a barrier to diffuse suppuration, but in the form of a synovial sheath it may facilitate the spread of inflammation. Butcher[1] believes that non-malignant growths differ from malignant in not incorporating adjoining tissues into their structure. Thus a cancer will involve by

[1] Lehrbuch, der Spec. Chirurg., Band II.

[1] Operative and Conservative Surgery, 255.

its growth surrounding parts; while a fibrous tumor by its increase will displace the surrounding tissues, or cause them to atrophy.

Gendrin[1] has observed that when the subserous cellular tissue, which always participates in the inflammation of a serous membrane, penetrates into the interior of an organ, it becomes a ready means of communicating the inflammatory action; but when the contiguous organ or subjacent part is of a structure different from that of the cellular tissue the extension inward is checked.

I. THE MUSCLES OF THE HEAD.

The muscles of the head form four groups—

The Muscles of the Face.
The Muscles of the Auricle.
The Muscles of the Orbit.
The Muscles of Mastication.

The Muscles of the Face.

The muscles of the face are divided into three sets: The fronto-palpebral; the nasal; and the oral groups.

The Fronto-Palpebral Group is composed of—

The Occipito-Frontalis.
The Pyramidalis Nasi.
The Orbicularis Palpebrarum.
The Corrugator Supercilii.

THE OCCIPITO-FRONTALIS.

This muscle consists of two portions—the occipital and the frontal—separated by an aponeurosis. The occipital portion arises from the outer two-thirds of the superior semi-circular line and from the mastoid portion of the temporal bone. It ascends a short distance (about two inches) to terminate in the aponeurosis. The frontal portion arises from the aponeurosis near the frontal eminence, and passes downward to be inserted into the brow, becoming thence continuous with the Pyramidalis Nasi. Both portions are thin, sheet-like expansions of muscular tissue, the occipital, however, being less intimately associated with the skin than the frontal.

The aponeurosis—the epicranial aponeurosis or galea aponeurotica—is a beautiful fibrous expansion uniting the occipital and frontal portions of the Occipito-Frontalis, and inclosing the crown of the head as a cap. It is intimately associated with the scalp above (a sparse distribution of granules of fat here and there intervening), a tedious dissection being required to separate them. It is very loosely attached to the pericranium, a little loose connective tissue alone intervening. Laterally the aponeurosis is gradually lost in the superficial temporal aponeurosis, and affords attachment to the Attollens and Attrahens Aurem muscles.

Use.—The Occipito-Frontalis elevates the brows in conjunction with the Pyramidalis. The conjoined action of the inner portions of both muscles may depress the median portion of the skin of the forehead. To secure this action the lateral part of the muscle must be active in elevating the brow.

Some individuals, by the alternate contraction of the occipital and frontal portions, are able to move the scalp backward and forward.

THE PYRAMIDALIS NASI.

This muscle, as already stated, is a continuation of the frontal portion of the occipito-frontalis muscle downward upon the nose, where it terminates in an aponeurosis in common with the origin of the Compressor Naris.

THE ORBICULARIS PALPEBRARUM

is, as the name expresses, the muscle of the eyelids. It, moreover, surrounds the orbital margins, and encroaches slightly upon the temple and the face. It thus consists of two portions, the palpebral covering the lids, and the orbital surrounding the orbit.

The palpebral portion arises from the palpebral ligament, and describes an ellipse entirely upon the lids.

The orbital portion arises from the inner border of the orbit at the nasal process of the superior maxilla. Its ellipse is interrupted at the brow by the fibres of the occipito-frontalis muscle. Below an oblique fasciculus passes downward and inward from the outer border of the muscle to the Levator Labii Superioris. While the inner and upper borders are fixed, the lower and outer are free. The fasciculi at the brow are short and compact, but those overlying the external angular process and the malar eminence are long, and exhibit a looser texture.

Use.—By the palpebral fibres to elevate the lower eyelid and to depress the upper. By the orbital fibres to act as a sphincter to the region about the lids. The former fibres are involuntary, while the latter are under the control of the will.

[1] Histoire Anatomique des Inflammation, i. 314.

According to Roser, the anterior layer of the inner division of the Orbicularis Palpebrarum dilates the lachrymal sac, while the posterior layer serves apparently to compress it.

The so-called tendon of the Orbicularis runs transversely over the middle of the lachrymal sac; consequently, when this is swollen, the resulting tumor appears sometimes to be divided into an upper and a lower portion.

THE CORRUGATOR SUPERCILII.

This muscle arises from the supra-ciliary ridge near its inner part, passes outward and upward, and is inserted into the brow. It is a small muscle, and is probably an imperfectly isolated group of fasciculi belonging to the preceding muscle.

THE TENSOR TARSI.

The Tensor Tarsi (Horner's muscle) is a deep fascicle of the ciliary fibres of the Orbicularis Palpebrarum. It arises from the lachrymal bone behind the lachrymal sac, and divides into two portions, a superior and an inferior. Each portion follows the direction of the lachrymal canal adjacent to it, and is lost on the structures about the median border of the corresponding tarsal cartilage.

The Nasal Group includes the following muscles:—

The Compressor Naris.
The Depressor Alæ Nasi.
The Dilator Naris Anterior et Posterior.

The Compressor Naris, the Depressor Alæ Nasi, and the Dilatores Naris are unimportant fascicles whose actions are implied in the names they bear.

The Compressor Naris arises by a narrow surface from the canine fossa of the superior maxilla. The fibres diverge from one another, and are inserted on a fibrous expansion at the side of the nose. This muscle descends to the alveolar line, and lies to the outer side of the Depressor Labii Superioris, and on nearly the same plane with the Levator Anguli Oris.

The Depressor Alæ Nasi arises from the superior incisive fossa of the superior maxilla, and is inserted into the integument over the nasal septum. A few fibres pass to the ala as well.

Indistinct fibres of the Dilatores Naris pass between the cartilages of the ala and the integument.

The Oral Group is composed of—

The Orbicularis Oris.
The Levator Labii Superioris Alæque Nasi.
The Levator Labii Superioris Proprius.
The Zygomaticus Major.
The Zygomaticus Minor.
The Levator Anguli Oris.
The Depressor Labii Superioris.
The Depressor Anguli Oris.
The Levator Labii Inferioris.
The Mentalis.

THE ORBICULARIS ORIS

is a thin layer of muscular fibres surrounding the mouth. It sends slips upward to the nose, and receives the remaining muscles of the oral group and the Buccinator. The labial fibres are continuous around the angle. Slips are sent off from the muscle to the septum and alæ of the nose.

Relations.—The skin is intimately associated with the muscle in front, while the mucous membrane overlies it behind. It is supplied by branches of the facial nerve and the fifth pair, and receives a coronary branch of the facial artery.

THE LEVATOR LABII SUPERIORIS ALÆQUE NASI

arises from the nasal process of the superior maxilla near the inner border of the orbit, where some of its fibres are continuous with those of the Orbicularis Palpebrarum. It passes downward, and is inserted upon the wing of the nose and the upper lip.

THE LEVATOR LABII SUPERIORIS PROPRIUS.

This muscle arises from the lower edge of the inner third of the orbit, from the superior maxilla, and from the malar bone. It passes downward to the upper lip. Lying upon the same general plane as the muscle last described, it is often united with it.

Relations.—The muscle lies just beneath the skin, but is overlapped above by the lower fibres of the Orbicularis Palpebrarum. Beneath it lie the infraorbital nerve and blood-vessels, and the Levator Anguli Oris.

THE ZYGOMATICUS MAJOR.

The Zygomaticus Major arises from the malar bone, and passes downward and forward to be inserted into the angle of the mouth.

THE ZYGOMATICUS MINOR.

The Zygomaticus Minor arises from the superior maxilla between the two last-mentioned muscles, and passes downward, parallel with the Zygomaticus

Major, to be lost in the upper lip near the angle. It is often only a slip of the Orbicularis Palpebrarum, and is frequently absent.

THE LEVATOR ANGULI ORIS.

The Levator Anguli Oris arises from the superior maxilla at the canine fossa, and passes downward and slightly outward to the angle of the mouth.

THE DEPRESSOR LABII SUPERIORIS.

The Depressor Labii Superioris arises from the superior maxilla at the incisive fossa, and passes upward to the lower border of the nostril, and to the septum between the nostrils. It can be best displayed by removing the mucous membrane from the upper lip. It constitutes in part the M. Nasalis of Henle.

THE DEPRESSOR ANGULI ORIS

arises by a broad base from the external oblique line at the basal portion of the lower jaw. It narrows as it passes upward, and is inserted into the angle of the mouth.

THE DEPRESSOR LABII INFERIORIS

arises from the lower jaw, between the symphysis and the mental foramen, and passes upward to the lower lip. Its fibres are interspersed with fat.

THE MENTALIS.

The Mentalis muscle arises from the alveolar processes of the lower incisor teeth, and passes radially outwards to the skin. It can be displayed by making an antero-posterior incision from the skin to the bone.

THE BUCCINATOR.

This muscle, ordinarily included in the facial muscles, or muscles of expression, belongs more properly to the pharyngeal constrictor group. It may be said to be projected from this group into the face. It arises from the pterygo-maxillary ligament, and from the alveolar line of both the upper and the lower jaw, opposite the position of the molar teeth. Its fascicles pass forward to be inserted into the angle of the mouth. A partial interlacing of the upper and the lower sets of fasciculi is noticeable.

Relations.—This muscle is remarkable for being covered by a thin fascia, thus distinguishing it from the other facial muscles. It is pierced by the parotid duct opposite the second molar tooth. In well-nourished individuals a lobule of soft fat lies between the Buccinator and the fat of the skin, and is continued upward between this muscle and the Masseter.

THE FASCIA OF THE MUSCLES OF THE FACE.

The skin of the face and of the vault of the cranium is not separated from the fat which lies beneath it; nor are the muscles ensheathed, but, instead, the fat and muscles are intricately associated.

This absence of fascia is compensated for by cushiony masses of connective tissue, which are conspicuous in the following localities: the hollow of the cheek; beneath the Zygomaticus, and over the Buccinator muscle, especially near the root of the coronoid process; beneath the lower fibres of the Orbicularis Palpebrarum, particularly where it overlaps the elevators of the upper lip; between the latter group of muscles and the elevators of the oral angle; at the groove for the facial artery as it passes over the lower jaw; and at the symphysis menti beneath the depressor of the lower lip.

The skin of the face is everywhere thin, so that its scars are as a rule inconspicuous. A very different result follows extensive cicatrization of the deeper parts. Here the connective tissue is abundantly present, and, as seen after ulcerations from mercurial sore mouth, or after destructive stomatitis from any cause, serves to contract the oral fissure, and, as it were, to convert the cheeks into false ligaments holding the jaws close together. Anchylosis of the temporo-maxillary articulation, as a result of such contraction, is of common occurrence.

In conditions more closely approximating the nor-

EXPLANATION OF PLATE XLIII.

Fig. 1. The muscles of expression.
Fig. 2. The temporal muscle.
Fig. 3. The muscles of the side of the face and the neck.

PLATE XLIII

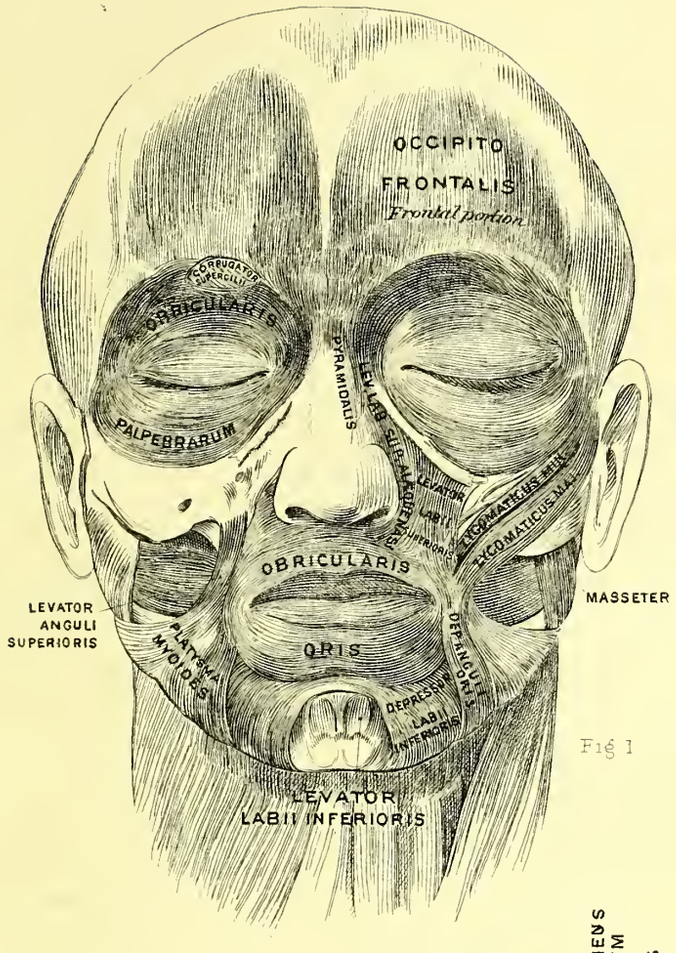


Fig 1

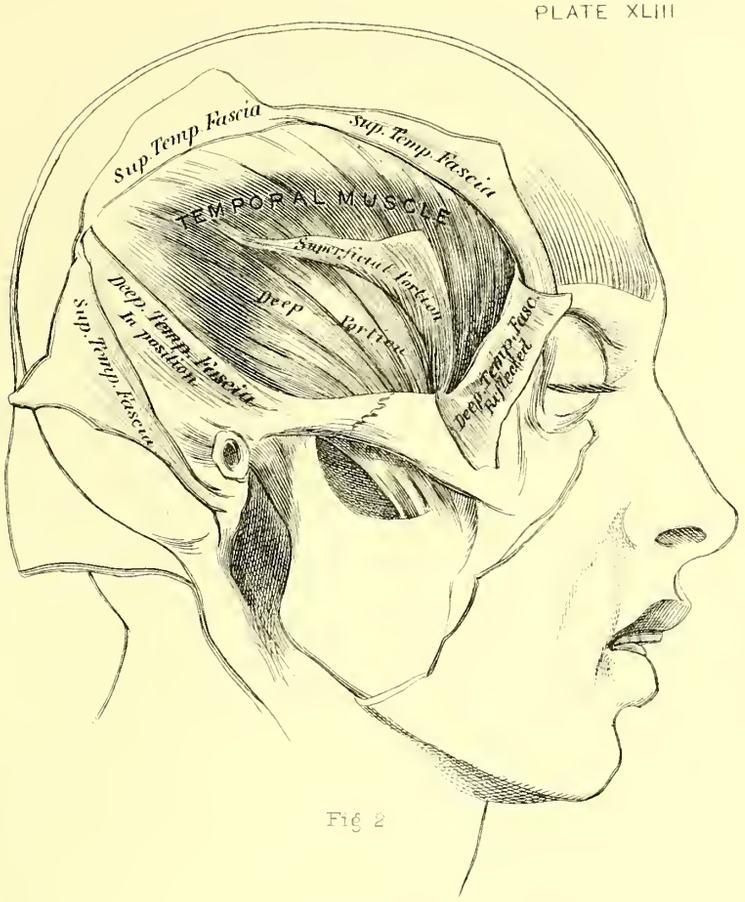


Fig 2

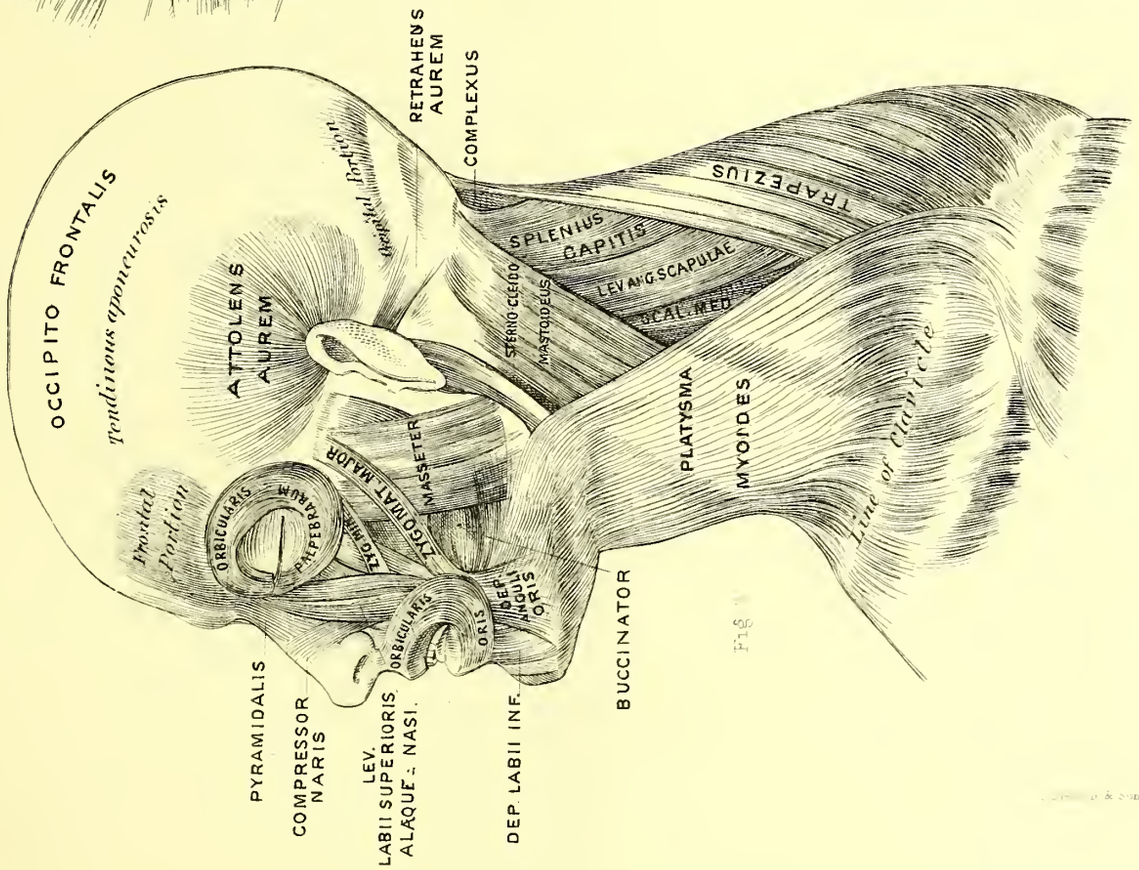


Fig 3

mal, as in facial ecchymosis or emphysema, it is seen that a free communication by means of the connective tissue exists between the neighboring parts and the region of the muscles of expression. *Ecchymosis* is commonly limited to the injured spot, but sometimes, as in old persons, it may be extensive. After fracture of the jaw ecchymotic swelling may rapidly spread from the point of lesion downward under the skin of the neck and chest, upward to the cheek, and to the lower eyelid of the opposite side, as well as inward to the mucous membrane both of the hard and of the soft palate.

Emphysema of the face is more rare. It may follow fracture of the frontal bone over the sinus, when it will be limited to the parts about the forehead; or an ulcer of the mucous membrane may give rise to it. T. P. Heslop[1] narrates a case of fatal emphysema in a boy aged four years, who, while recovering from measles, suffered from ulceration at the angle of the mouth. The air-distended connective tissue extended from this point downward along the entire length of the trunk. At the autopsy it was found that the mucous membrane at the oral angle was separated from the integument, so that the handle of a scalpel could be inserted nearly an inch into the cheek.

The Fat of the face is abundant beneath the cheeks, but is sparsely distributed upon the lips, the nose, the eyelids, and the forehead. The fibres of some of the muscles are interspersed with lobules of fat, as is well seen in the depressor of the lower lip. As a rule, however, the fat lies beneath the skin and around the more superficial muscles, or is less uniformly distributed among the deeper muscles. A pad is quite constantly found beneath the quadrate elevator of the upper lip and the elevator of the oral angle; and a second between the latter muscle and the bone about the infra-orbital nerve.

The fat presents a granulated appearance in the infant. The fulness of the cheek in the young is not due to the superficial layer alone, but to the deeper-seated mass lying partly upon the Buccinator and partly upon the Masseter muscle. The latter-named mass has received the name of the "button" from its figure, which is abruptly constricted at its base, where it is continuous with the fat of the temporal fossa.

The "button" is surrounded by capsule-like connective tissue, and is crossed by branches of the transverse facial nerve. As a natural result of the prominence of the cheek in a young child, a fall upon the face is apt to result in its injury. If laceration should involve the "button," this structure may appear, according to Boyers,[1] between the lips of the wound.

In *facial œdema* the degree of effusion of serum into the tissues of the region of expression will be naturally determined by the distribution of the fat and the connective tissue. In determining the degree of impairment in the return of the venous blood upon which the occurrence of œdema depends, it is found that the amount of facial œdema bears an exact relation to the amount of involvement of the submucous connective tissue. In the familiar instance of swelling of the face accompanying an alveolar abscess, the exciting cause lies within the alveolar process, which transmits the irritation to the submucous connective tissue, and thence to the cheek.[2]

When the œdema is excessive, as in erysipelas, the buccal and the labial tissues will be first affected. The lips will be everted and thickened, and the eye closed, more, however, by the pushing upward of the lower eyelid by the engorged buccal tissues than by any change in the structures of the upper eyelid.[3] In the swelling of decomposition the lips become greatly everted, and the lower eyelid puffed up. These are due to both of the causes above mentioned.

The position of local œdema of the forehead is determined as follows: The resistance on both sides furnished by the skin without and the pericranium within is so great that the swelling assumes a flattened form, and gravity will aid it in taking a position below its point of origin. Thus, in a person stung on the forehead by a bee, the greater amount of swelling takes place *below* the injured point.

[1] Med. Times and Gaz., 1868, 638.

[1] Med. Times and Gazette, 1868, 138.

[2] Involvement of a mucous surface tends to the formation of submucous œdema in all instances. In the intestines, however, the presence of a serous covering materially modifies the process, and indeed the fluid is forced, through increased activity of the follicular glands, directly into the alimentary canal. The process is also modified in the trachea and the bronchial tubes. In the mouth, the nose, the pharynx, and the parts about the glottis, there is no such limitation, and œdema is developed at once in the submucous tissue.

[3] Another example of submucous œdema is seen in the conjunctival chamber. A very slight degree of irritation will cause in this region protrusion of the conjunctival membrane, which, when the irritation is excessive, is seen to escape from the palpebral chamber and to lie as a red and thickened fold between the lids. This condition is recognized as *chemosis*. Persistent chemosis leads to general infiltration of the structures of the lids when the subcutaneous tissues become involved. This, however, is not common except in severe general ophthalmia. It is an interesting fact that a subcutaneous œdema may be dependent upon one which primarily was of submucous origin.

In a case of necrosis of the frontal bone, where the offending fragment was situated near the frontal eminence, the writer found the associated œdema near the median line at the brows. Such a collection is very deceptive. Its resisting boundaries give to the fluid the physical signs of an abscess, and if it is associated with redness of the skin the incautious may needlessly open it.

Paget[1] believes emphysema of the forehead to be a common sign in fracture of the frontal bone involving the frontal sinus.

The Fascia of the Side of the Face.—Immediately beneath the skin of the temple is a well-defined though thin layer of fat, which is continuous with that covering the parotid gland. On the temple this fat is in intimate association with the superficial temporal fascia and its continuation downward into the so-called parotid fascia. The manner of the connection of this fascia with the tendon of the Occipito-Frontalis and with the auricular muscles is worthy of careful study. With a little care it can be lifted from the parotid gland so as to include within it the superficial lamina of the masseteric fascia, the deep lamina being continuous with the cervical fascia. This arrangement would point to the conclusion that the masseteric fascia is derived from below (deep layer), as well as from above (superficial layer). Between them passes the transverse facial branch of the temporal artery. Filaments of the facial nerve lie also in this position. By tracing the filaments backward, or by freely elevating the fascia and the superficial lobules of the parotid gland from the position of the venules which are constantly found lying directly in front of the auditory meatus, the entire *pes anserinus* of the facial nerve can be displayed. The position of the firm masseteric fascia prevents the Masseter muscle receiving its arteries and nerves from in front. The entrance of the artery into the muscle at the sigmoid notch caused Velpeau[2] to assert that in dislocation of the lower jaw the vessel is of necessity compressed.

The Muscles of the Auricle.

The Auricular Muscles—namely, those that are inserted into the auricle—are three in number:—

The Attollens Aurem.
The Attrahens Aurem.
The Retrahens Aurem.

[1] Med. Times and Gaz., 1867, 251.
[2] Chirurg. Anat., i. 80.

The Attollens Aurem.

The Attollens Aurem arises from the superficial temporal fascia by a broad fan-shaped origin. It is a thin band of pale fibres, which narrows to a small point of insertion upon the upper surface of the auricle near the external meatus.

The Nerve-supply is secured from the small occipital.

The Attrahens Aurem.

This small flat muscular fasciculus arises from the superficial temporal fascia in front of the auricle, and is inserted into the tragus.

The Nerve-supply is derived from the facial and the auriculo-temporal branch of the inferior maxillary.

The Retrahens Aurem.

The Retrahens Aurem, stouter than the remaining muscles of the group, is composed of two or three separate fascicles. It arises from the temporal bone at the mastoid portion, and passes forward, slightly narrowing as it is inserted into the posterior aspect of the auricle. It lies on the same plane as the occipital portion of the Occipito-Frontalis muscle.

The Nerve-supply is derived from the posterior auricular branch of the facial.

Remarks.—The above are all rudimentary forms of larger muscles found in the lower animals. They are, as a rule, not under the control of the will, and usually are incapable of moving the external ear. The first two would appear to assist in maintaining lateral traction upon the epicranial and temporal aponeuroses.

The Muscles of the Orbit.

The Muscles of the Orbit are as follows:—

The Levator Palpebræ Superioris.
The Superior Rectus.
The Inferior Rectus.
The Internal Rectus.
The External Rectus.
The Superior Oblique.
The Inferior Oblique.

The Levator Palpebræ Superioris.

The Levator Palpebræ Superioris arises from the upper margin of the optic foramen, as a narrow,

ribbon-shaped band. It passes forward, expanding as it does so, and is inserted upon the anterior surface of the upper tarsal cartilage.

In the case of a boy aged five years, this muscle was found by Dr. J. Green[1] torn completely across, with resultant falling of the upper eyelid. After an interval of two years the retracted end of the muscle was attached to the tarsal cartilage, and its function entirely re-established.

THE RECTI AND OBLIQUE MUSCLES.

The four Recti muscles can be considered together.

They arise from the borders of the optic foramen, diverging thence as straight flattened bands, and are inserted by tendinous fibres in the sclera, two or three lines from the border of the cornea.

The Superior Rectus is the weakest, and is separate from the others, which have an origin almost in common.

The External Rectus is the strongest of the muscles of its group. It commonly arises in two portions, the lower of which secures a small attachment from the lower edge of the sphenoidal fissure; through which opening the third and the sixth cranial nerves pass, together with the naso-ciliary branch of the fifth nerve and the ophthalmic vein.

In some cases of single convergent strabismus the Internal Rectus of the squinting eye is much smaller than its fellow of the opposite side.

The Superior Oblique also arises at the border of the optic foramen. It extends to the upper inner angle of the orbit, and becomes tendinous as it passes round the trochlear process of the frontal bone. Beyond this point the muscle again assumes a fleshy appearance, is deflected backward and outward, and is inserted upon the sclera beneath the insertion of the Superior Rectus, at a point midway between the Superior and the External Recti muscles, and nearly equidistant from the cornea and the entrance of the optic nerve.

Budge[2] describes a variety of the Levator Palpebræ Superioris in which a bundle of filaments joined the Superior Oblique muscle.

Relations.—Above is the roof of the orbit; beneath lie the nasal nerve and the Internal Rectus muscle; the fourth nerve enters the upper surface. A minute bursa is situated beneath the tendon of this muscle as it passes the trochlea.

[1] Trans. Am. Oph. Soc., 1871, 134.

[2] Zeit. für. rat. Med., 1859, 273.

The Inferior Oblique muscle arises from the inner end of the floor of the orbit. It passes beneath the terminal portion of the Inferior Rectus above, and behind to the outer surface of the sclera, upon which it is inserted between the entrance of the optic nerve and the tendon of the External Rectus.

Uses.—The Superior Rectus muscle moves the eyeball upward.—The Inferior Rectus moves it downward.—The Internal Rectus moves it inward.—The External Rectus moves it outward.—The Superior Oblique rotates the eyeball, and moves it downward.—The Inferior Oblique rotates the eyeball, and moves it upward. Both the oblique muscles, when acting together, can draw the eyeball slightly forward.

The Superior and the Internal Rectus acting together will draw the eyeball in a direction neither upward nor inward, but in a line between. In like manner the combined action of any two related muscles will move the eyeball in a direction between the lines of traction of the muscles acting separately.

The function of the Levator Palpebræ muscle is antagonized by that of the Orbicularis Palpebrarum. In the normal status resulting from the harmonious action of the two muscles the upward movement of the eyelid is less pronounced than when this harmony is destroyed by paralysis of the Orbicularis. In facial palsy, for example, the upper eyelid of the affected side is raised a little higher than the other. The Levator is relaxed when the eyelids are closed.

The capsule of Tenon is a name given to a fibrous envelope of the sclera. It arises from the borders of the orbit, passes behind the conjunctiva to the corneal border, and covers the eyeball from that point as far as the entrance of the optic nerve. It is pierced by the tendons of the periocular muscles, and permits rotation of the ball to take place within its embrace.

From the outer surface of the capsule delicate processes can be traced along the course of the muscles, and from its peripheral connections with the walls of the orbit septa pass, to strengthen the lachrymal sac and eyelids on the inner side, and the external palpebral ligament on the outer.

THE PERIOCULAR SPACE.

This space is defined by the eyeball and the walls of the orbit, and may be said to include the contents of the orbit; the eyeball, and the optic nerve, as it lies within the orbit, alone being excepted. The space is occupied by delicate connective tissue and fat, and being enclosed measurably by the capsule of Tenon

is conveniently included under the same heading with the fasciæ of the head and face.

The periocular space is of interest from the variety of ways in which it may be involved in lesions of the neighboring parts. The inflamed lachrymal gland will press upon it, and the pus from a glandular abscess may flow into it. Abscess of the frontal sinus may also implicate it, as may the inflammation attendant upon ostitis or necrosis of any portion of the orbital walls. Distension of the maxillary sinus may narrow the orbit by elevation of its floor, and thereby alter the normal relations of parts within the periocular space.

The Movements of the Eyelids.—The lids in great measure follow the lines of motion of adjacent facial and orbital muscles. If the elevation of the upper lid is decided, it is always accompanied by elevation of the brows and by upward movement of the eyeball. The lower eyelid also moves upward slightly in the movement just described. W. R. Gowers[1] ascribes this to the pressure of the lower convexity of the sclera against the tarsal cartilage, a pressure which can be readily seen or felt if the finger is placed upon the lower eyelid during the movement. In like manner the downward motion of the eyeball tends to draw the upper eyelid downward. The two last-mentioned motions being accompanied with rotation of the eyeball, it follows that at least one of the uses of the oblique muscles is to secure, in the rotation and the slightly protruding motion above mentioned, such pressure against the eyelids as to permit of these secondary motions. As the upper eyelid descends the lower eyelid ascends slightly, and is drawn inward.

The Nerves of the Superior Rectus, Inferior Rectus, Internal Rectus, Inferior Oblique, and Levator Palpebræ are secured from the third cranial nerve. The motor nerve of the Superior Oblique is derived from the fourth cranial nerve, and that of the External Rectus from the sixth. To the ophthalmic branch of the fifth nerve is due the general sensibility of all the muscles of the group.

[1] Med. Chir. Trans., lxii. 432.

The Muscles of Mastication.

These comprise—

The Masseter.
The Temporal.
The Internal Pterygoid.
The External Pterygoid.

They are all powerful muscles inserted into the ramus of the lower jaw, and supplied by the inferior maxillary division of the fifth cranial nerve.

THE MASSETER.

The Masseter is a stout quadrilateral muscle extending from the zygomatic process to the outer surface of the ramus of the lower jaw. It is composed of two portions, the superficial and the deep, of which the former is the larger and stronger. The superficial part arises by tendinous fibres from the anterior two-thirds of the zygomatic arch and the lower margin of the malar bone, and passes downward and slightly forward to be inserted into the lower half of the ramus and the angle of the jaw upon its outer side. The deeper layer is tendinous below, namely, at the line of insertion, and is less obliquely situated than the superficial. The posterior edge of the muscle exhibits a separation into two layers, but at the anterior edge these layers are united. Monro described a bursa lying in the pouch-like space between the two layers.—The anterior border of the Masseter, formed, as already mentioned, of both layers, is thick and columnar. It can be readily felt by the finger inserted between the cheek and the malar bone. The division of the muscle at this point for false anchylosis of the temporo-maxillary articulation could be better secured by a submucous than by a subcutaneous myotomy.[1]

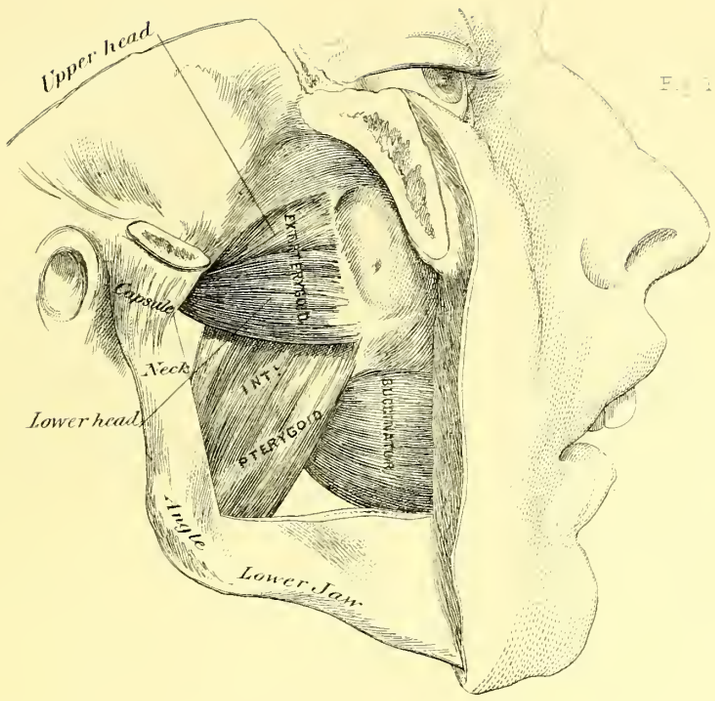
Dr. Dixon[2] describes an instance in which sloughing of this muscle followed intense traumatic inflammation.

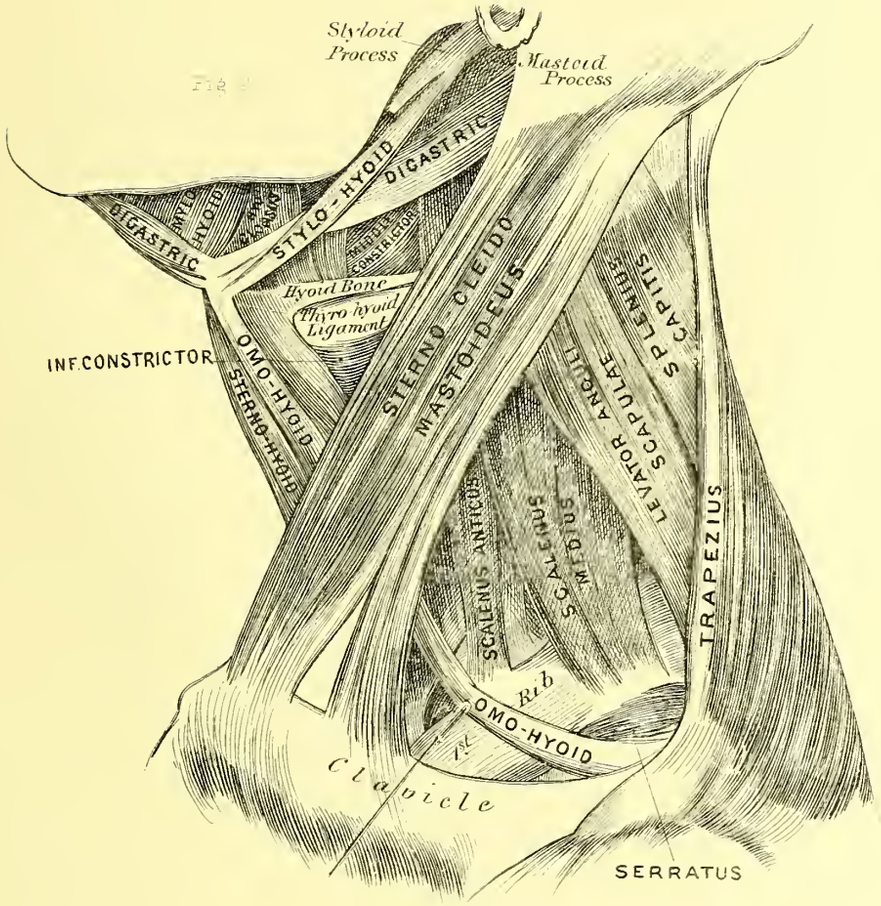
Relations.—The muscle is covered by the masseteric fascia (which adheres intimately to the tendon of origin)

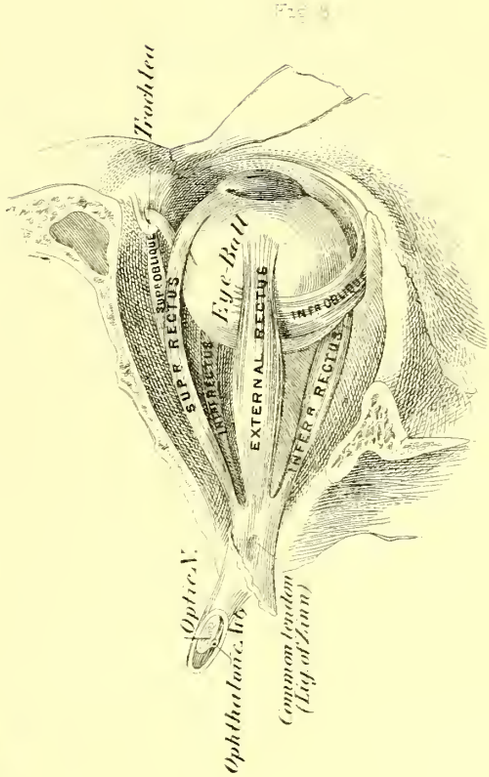
[1] R. L. Howard, N. Y. Journ. of Medicine, 1848, 177.
[2] Trans. Path. Soc. London, ii. 276.

EXPLANATION OF PLATE XLIV.

Fig. 1. The pterygoid and the buccinator muscles.
Fig. 2. The muscles of the neck.
Fig. 3. The superficial muscles about the eyeball.


Upper head
Capsule
Neck
Lower head
EXTERNAL PTERYGOID
INT. PTERYGOID
BUCCINATOR
Angle
Lower Jaw


Styloid Process
Mastoid Process
STYLO-HYOID
DIGASTRIC
DIGASTRIC
MIDDLE CONSTRICTOR
Hyoid Bone
Thyro hyoid Ligament
INF. CONSTRICTOR
OMO-HYOID
STERNO-HYOID
STERNO CLEIDO MASTOIDEUS
SPLENIUS
LEVATOR SCAPULÆ ANGULI
TRAPEZIUS
SCALENUS ANTICUS
SCALENUS MEDIUS
Rib
OMO-HYOID
Clavicle
SERRATUS


Forehead
SUPERIOR OBLIQUE
SUP. RECTUS
Eye-Ball
INFERIOR OBLIQUE
EXTERNAL RECTUS
INFER. RECTUS
Optic N.
Ophthalmic Ar.
Common tendon (Lig. of Zinn)

and by the skin. It is overlapped slightly from behind by the parotid gland, and crossed by the parotid duct and filaments of the facial nerve. Below it are the ramus of the lower jaw and the terminal portion of the tendon of the Temporal muscle, while in front lies the Buccinator, from which the Masseter is separated by a mass of delicate fat.

Use.—The Masseter elevates the lower jaw, and draws it slightly forward.

Artery.—The muscle is supplied by the masseteric artery, a branch of the internal maxillary.

Nerve.—The muscle receives a branch of the facial nerve at the sigmoid notch.

THE TEMPORAL.

The Temporal muscle arises by fleshy fibres from the entire surface of the temporal fossa (excepting that portion defined by the orbital septum) and from the upper third of the temporal aponeurosis. The latter structure is a beautiful glistening layer of fibres extending from the borders of the temporal fossa to the zygomatic arch. It is thin and weak at its origin, but increases in thickness as it descends, and divides near the zygoma into two leaflets. Between these is inserted a small quantity of compact adipose tissue. The Temporal muscle is composed of two portions—a superficial, thin and delicate, which arises from the aponeurosis; and a deep, which arises from the floor of the fossa. The fibres of the superficial are continuous above with the deep fibres, but below they are gradually lost in the deep layer of the Masseter muscle. The fibres of the deep portion, which compose the great bulk of the muscle, assume a position more vertical before than behind, where they are nearly horizontal. They gradually converge to a central tendon, which is inserted upon the coronoid process of the lower jaw, chiefly along its inner surface and anterior border.

Use.—To elevate the lower jaw.

Artery.—The muscle receives the temporal branches of the external carotid superficially, and the deep temporal branches of the internal maxillary artery from beneath.

Nerves.—Its nerves are branches of the facial and of the auriculo temporal.

Relations.—Superficially to the Temporal muscle lie the integument, the temporal fascia, and the aponeurosis of the Occipito-Frontalis muscle as it affords origin to the auricular muscles. Beneath lie a portion of the temporal fossa, the External Pterygoid muscle, and the internal maxillary artery.

Remarks.—Pus may be guided from a deep temporal abscess to the coronoid process, and thence into the mouth, along the loose fat lying about the deeper portion of the muscle. By means of the great thickness of the substance of the muscle an extensive fracture of the skull at the temporal fossa may be disguised. The delicacy of the fibres arising from the temporal fossa, and the radiate manner in which they pass from the bone, explain why blood is not found in a clot between the muscle and the skull in instances of fracture of the latter through the temporal fossa, but is found incorporated with the muscle-fibres themselves. In the language of clinical writers the muscle is said to be "infiltrated" with blood. If the bleeding has been extensive, the deep portion of the muscle presents the appearance of a firm blood-clot, which, however, is limited outwardly by the position of the tendon.

THE INTERNAL PTERYGOID.

The Internal Pterygoid muscle has a tendinous origin from the pterygoid fossa. The fibres pass backward, downward, and outward, and are inserted upon the inner surface of the angle and the ascending ramus of the lower jaw. The muscle is of coarse structure, and is interspersed with stout bands of fibrous tissue.

The Internal Pterygoid muscle is an important factor in maintaining false anchylosis of the temporo-maxillary joint. After division of the anterior border of the Masseter muscle this condition may persist, but the anchylosis readily yields to division of the Internal Pterygoid.[1]

Use.—In connection with the Temporal and the Masseter the Internal Pterygoid raises the lower jaw. In connection with the External Pterygoid it draws the lower jaw forward.

Relations.—From the oblique position of the muscle the relations of its median portion are different from those of its outer portion. Thus the former is related to the Tensor Palati and Superior Constrictor of the pharynx; while to the lateral side of the latter portion lie the internal lateral ligament, the internal maxillary vessels, and the inferior dental artery and nerve.

THE EXTERNAL PTERYGOID.

The External Pterygoid muscle arises by two heads from the sphenoid bone: one from the under surface of the great wing at the pterygoid ridge; and one from the outer surface of the external plate of the pterygoid

[1] C. S. Tenner, Am. Journ. Med. Sci., July, 1854, 131.

process as well as from several adjacent areas upon the palate bone and the superior maxilla. The two heads unite to form a short stout belly, which passes outward and backward to be inserted into the depression on the anterior surface of the neck of the lower jaw, and into the interarticular cartilage of the temporo-maxillary articulation.

Use.—To draw the head of the lower jaw forward, and to assist in the act of grinding the food.

Nerve.—The muscle receives its motor filaments from the inferior maxillary division of the fifth nerve.

Variations.—The muscle may receive a slip from the Temporal. Longitudinal cleavage may be seen in each of the heads. This separation, when taking place in the sphenoidal head, gives rise to a fascicle which receives the name of the Pterygoideus Proprius.

Relations.—The internal maxillary artery lies at first to the outer side of the muscle, and afterward passes inward between the two heads. The temporal and masseteric branches of the fifth nerve cross it near its origin, and the buccal nerve passes between the heads.

II. THE MUSCLES OF THE NECK.

The muscles of the neck embrace the following:—

The Muscles of the Supra-Hyoid Space.
The Muscles of the Pharynx and the Soft Palate.
The Platysma Myoides.
The Sterno-Cleido-Mastoideus.
The Depressors of the Hyoid Bone.
The Deep Lateral and the Prevertebral Muscles.

The Muscles of the Supra-Hyoid Space (fig. 3, Plate XLIII.; fig. 2, Plate XLIV.; fig. 1, Plate XLV.).

The muscles of the space between the lower jaw and the hyoid bone (supra-hyoid space) include the following:—

The Digastric.
The Stylo-Hyoid.
The Mylo-Hyoid.
The Genio Hyoid.
The Genio-Glossus.
The Hyo-Glossus.
The Stylo-Glossus.

THE DIGASTRIC MUSCLE.

The Digastric muscle arises from the digastric groove of the temporal bone, and is inserted into the digastric fossa of the lower jaw, near the symphysis. As the name expresses, it has two bellies. The *posterior belly* is the longer and narrower of the two. The *anterior belly* is broad, and its fibres sometimes decussate with those of the muscle of the opposite side. The tendon uniting the bellies is held down to the hyoid bone by a firm loop of fibrous tissue, so that the muscle is more or less V-shaped. Commonly the Stylo-Hyoid muscle is perforated by this tendon.

Use.—The Digastric muscle depresses the lower jaw, and, when this bone is firmly fixed, elevates the hyoid bone.

Nerve.—The posterior belly is supplied by the facial, and the anterior by the mylo-hyoid branch of the inferior dental nerve.

Variations.—The entire muscle may undergo cleavage, or the posterior belly be alone divided. Accessions may be secured to the posterior belly from the styloid process, the angle of the jaw, or the Splenius. The intersection may be absent, and the muscle inserted on the side of the horizontal ramus of the lower jaw. Slips may pass from the anterior belly to the hyoid bone. The tendon may fail to pierce the Stylo-Hyoid muscle.

Relations.—The anterior belly is more superficial than the posterior. Above it lies the Platysma; below it, the Mylo-Hyoid muscle and the submental artery are found. The posterior belly has above it the anterior border of the Sterno-Cleido-Mastoideus muscle, and a lobule of the parotid gland. Below it lie the transverse process of the atlas, the internal jugular vein, the internal carotid artery, the second cervical nerve, the external carotid artery, and the origins of the facial and the lingual arteries.—The region of the intermediate tendon is overlaid by the Stylo-Hyoid muscle in part, and by the submaxillary gland. A little below the tendon lies the hypoglossal nerve.

THE STYLO-HYOID.

The Stylo-Hyoid muscle arises from the outer surface of the styloid process, between its middle and base. It is a slender muscle, and passes downward and inward to be inserted on the hyoid bone at the junction of the great cornu and the body. As a rule it is pierced for the transit of the tendon of the Digastric muscle.

Use.—To elevate the hyoid bone.

Nerve.—It is supplied by the facial nerve.

Variations.—Among the numerous variations of this muscle may be noted the following: Cleavage throughout—rarely three separate muscles may exist.—It may vary in its place of origin from the styloid process. It may be fused with the Omo-Hyoid at the hyoid bone. It may not be perforated by the Digastric. It may send slips to the lower jaw or Genio-Glossus. It may be inserted entirely into the lesser horn.

Relations.—These are essentially the same as those of the posterior belly of the Digastric.

THE MYLO-HYOID.

The Mylo-Hyoid muscle arises from the mylo-hyoid ridge of the lower jaw. Its fibres are, strictly speaking, entitled to the name only upon the outer margin of the muscle, since here alone are they inserted into the hyoid bone. The remaining fibres are more oblique in position, become successively shorter from below upward, and are inserted into a median raphé. This raphé, at all times indistinct, is often incomplete or absent when the division between the right and left muscle is destroyed.

Use.—The Mylo-Hyoid muscle forms the muscular floor of the mouth. It assists in raising the hyoid bone and drawing it forward. It also depresses the lower jaw.

Relations.—The Mylo-Hyoid muscle is at once the floor of the mouth and, at least in part, the roof of the neck. It lies superficially to the Genio-Hyoid muscle; has the anterior belly of the Digastric and the submental artery superficial to it; and permits the duct of the submaxillary salivary gland to effect entrance beyond its outer border. Upon the deep or oral surface lie the lingual nerve, the sublingual gland, and the mucous membrane of the alveo-lingual groove.

Variations.—It may be fused with the Digastric, or be absent when the last-named muscle takes its place. It may be continued by a few slips with one or more of the depressors of the hyoid bone. It may be perforated and dissected by the lobules or duct of the submaxillary salivary gland.

THE GENIO-HYOID.

The Genio-Hyoid muscle arises from the inferior genial tubercle of the lower jaw, and passes downward to be inserted into the anterior surface of the body of the hyoid bone.

Use.—With other muscles of its group to depress the lower jaw and to elevate the hyoid bone.

Nerve.—The Genio-Hyoid is supplied by a branch of the hypoglossal nerve.

Variations.—The muscle may undergo complete cleavage, or fuse with the corresponding muscle of the opposite side. Slight variations are met with in the extent of the mandibular and hyoidean attachments.

Relations.—Above is the Mylo-Hyoid. Below are the Hyo-Glossus in part, and the Genio-Glossus.

THE GENIO GLOSSUS.

The Genio-Glossus muscle arises at the symphysis of the lower jaw from the upper portion of the genial tubercle. It radiates through the tongue from before backward, constituting the bulk of the structure of this organ.

Under the erroneous impression that this muscle secures an important origin from the body of the hyoid bone, it is frequently described under the name Genio-Hyo-Glossus.

Use.—To draw the tongue forward.

Nerve.—It is supplied by the hypoglossal nerve.

Some of the fibres of the Genio-Glossus extend from the tongue to the anterior surface of the epiglottis. Some of the fibres of the Stylo-Pharyngeus (through the pharyngo-epiglottic ligament) run to the epiglottis. An anomaly of movement of the epiglottis has been described consequent upon paralysis of the left recurrent nerve from pleuritic effusion.[1]

THE LINGUALIS.

The Lingualis muscle lies in the substance of the tongue. It is a longitudinal fasciculus extending from the tip to the base. Some of its fibres can be traced into the Stylo-Glossus and the Hyo Glossus muscles.

THE HYO-GLOSSUS.

The Hyo-Glossus muscle is a thin, quadrate muscle, arising from the upper border of the body of the hyoid bone, the lateral border of the great cornu, and the lesser cornu. It passes upward and slightly forward to be inserted into the posterior lateral border of the tongue.

Use.—To aid in depressing the tongue.

Nerve.—The muscle receives a branch of the hypoglossal nerve.

Relations.—Above the muscle lie the Stylo-Hyoid, the Digastric, and the Mylo-Hyoid muscles, and part of the submaxillary gland. It is crossed by the hypoglossal nerve, and is pierced by Wharton's duct. The muscle rests upon the Genio-Glossus and the origin of the Middle Constrictor. Lying conspicuously beneath it is the lingual artery, and higher up is the glosso-pharyngeal nerve.

Variations.—It may be composed of a number of separate bundles. It may receive a slip from the Thyro-Hyoid.

THE STYLO GLOSSUS.

The Stylo-Glossus muscle arises from the tip of the styloid process. It passes downward and forward, and is inserted into the side and base of the tongue—some of its fibres crossing those of the Hyo-Glossus.

Use.—To aid in the retraction and elevation of the tongue.

Variations.—It may be absent. Its origin may secure accessions from the Internal Pterygoid, the angle of the lower jaw, the stylo-maxillary ligament, the tympanic portion of the temporal bone, or even from the cartilaginous external auditory meatus. Slips may pass to the pharynx.

[1] Schröeter, quoted in Boston Med. and Surg. Journ., April 8, 1875, 411.

The Muscles of the Pharynx and the Soft Palate.

These embrace—

The Superior Constrictor.
The Middle Constrictor.
The Inferior Constrictor.
The Stylo-Pharyngeus.
The Palato-Glossus.
The Palato-Pharyngeus.
The Tensor Palati.
The Levator Palati.
The Azygos Uvulæ.

THE SUPERIOR CONSTRICTOR.

The Superior Constrictor arises from the lower portion of the internal pterygoid plate, the pterygo-maxillary ligament, the mylo-hyoid ridge of the lower jaw, and the side of the tongue. The fibres from this extensive and varied origin pass directly backward, and are inserted on the posterior wall of the pharynx from the level of the angles of the lower jaw to the occipital bone; a few fascicles being received upon the pharyngeal spine and the aponeurosis attached to the basilar process of the occipital bone. Some of the fascicles are continuous with the Buccinator, and others with the Genio-Glossus.

The upper margin of the muscle is concave, and resembles the festooned border of a curtain held up at two points: viz., the pterygoid process in front, and the pharyngeal aponeurosis behind. The space intervening between the upper border and the base of the skull is occupied by the aponeurosis just named. The remaining fibres are nearly transverse. The lower border of the muscle is lost in the wall of the pharynx, and is, in part, overlapped by the more oblique fibres of the Middle Constrictor.

Use.—The pterygoid fibres, fixed as they are at their ends, convert, during contraction, the curved upper border into a straight one, and exert lateral pressure against the side of the naso-pharynx. Neither these, the buccal, nor the mandibular fibres can have a constricting action. The mandibular fibres can draw the posterior wall of the pharynx forward. The glossal fibres assist the Middle Constrictor.

Variations.—The several portions of the muscle may be distinct. Under the head of the Azygos Pharyngis, Meekel describes a small slip arising from the pharyngeal spine and becoming lost on the median line of the posterior pharyngeal wall.

Relations.—Lying to the outer side of the muscle are the internal carotid artery, the pneumogastric, the glosso-pharyngeal, and the spinal accessory nerves. Adjacent to the inner side are the Eustachian fossa and the origin of the Levator Palati muscle.

THE MIDDLE CONSTRICTOR.

The Middle Constrictor muscle (Plate XLV. fig. 2) arises from the greater and the lesser cornu of the hyoid bone. The fibres of the several portions pass upward and backward, directly backward, and backward and downward, and are inserted on the median line at the posterior wall of the pharynx from a short distance below the level of the hyoid bone to a point near the occipital bone. The upper fibres overlap the Superior Constrictor, in part, as the lower fibres in turn overlap the Inferior Constrictor.

Use.—To assist in elevating the hyoid bone; to adduct the cornu of the hyoid bone, and to draw forward the posterior pharyngeal wall. The hyoid bone is elevated by the Stylo-Hyoid muscle at the completion of the movement just named, and the fibres become of necessity less oblique than when the muscle is at rest.

Variations.—The slips from the lesser cornu may be distinct from those arising from the greater. Fibres may arise from the stylo-hyoid ligament, as well as from the body of the hyoid bone and the thyro-hyoid ligament. Fibres of continuity with the Genio-Glossus are here noted as in the case of the Superior Constrictor. The upper fibres may reach the occipital bone.

Relations.—Between the Superior and Middle Constrictors, at the side of the pharynx, the Stylo-Pharyngeus muscle passes. The superior laryngeal nerve lies between the Middle and Inferior Constrictor on its way to the thyro-hyoid membrane.

THE INFERIOR CONSTRICTOR.

The Inferior Constrictor muscle (Plate XLV. fig. 2), the shortest of the three, arises from the side of the thyroid cartilage, at the oblique lateral ridge, at the cricoid cartilage, and from a tendinous arch between these two points; the fibres pass upward and backward to be inserted on the median line of the pharynx for over one-half its length. The lower fibres are shortest, and merge gradually into the circular fibres of the œsophagus.

Use.—To constrict the lower part of the pharynx, and to serve as a protection to the laryngeal aperture. As such it may be seen in the living subject acting independently of the other muscles of its set. It assists in the propulsion of the bolus of food. In young subjects it may have some power in adducting

the halves of the thyroid cartilage, and thus lessening the transverse diameters of the larynx.

Variations.—Slips may be received from the Thyro-Hyoid, the Crico-Thyroid, and the Sterno-Thyroid muscles. The muscle may receive a few fascicles directly from the trachea.

The pharynx, in addition to the muscles named, is strengthened by submucous longitudinal fibres, and by the fibres of insertion of the Stylo-Pharyngeus, the Palato-Pharyngeus, and other fascicles passing from the cartilage at the orifice of the Eustachian tube.

THE STYLO-PHARYNGEUS.

The Stylo-Pharyngeus is a slender muscle arising from the styloid process and inserted into the side of the pharynx between the Middle and the Inferior Constrictor.

Use.—It aids the Stylo-Hyoid muscle in elevating the pharynx.

Nerve.—This muscle is supplied by a branch of the glosso-pharyngeal nerve.

Relations.—Beneath the muscle lies the ascending pharyngeal artery. Above it lies the submaxillary salivary gland.

THE PALATO-GLOSSUS

arises from the anterior surface of the soft palate at the base of the uvula, and passes downward along the lateral wall of the pharynx to be inserted into the side of the base of the tongue. It is of a dusky-red color in health, and the fold of mucous membrane over it forms the palato-glossal fold or the "anterior half arch."

Use.—To draw the palate slightly downward and forward. It also aids in keeping the tonsil in position. Both muscles acting together depress the soft palate and draw it forward, and, in the act of sucking, constrict the nipple.

Each muscle may be looked upon as a sphincter on a deeper plane than the lips, but like it in nature, and it is supplied by the same motor nerve, viz., the facial. It is also a noteworthy fact that the plane of the two muscles limits the region of involution of the epiblast—so that the palato-glossal muscles are less splanchnic than the pharyngeal muscles proper.

THE PALATO-PHARYNGEUS

arises from the soft palate at the base of the uvula behind the Palato-Glossus. It passes downward to be inserted into the lower part of the side of the pharynx. Some of its fibres can be occasionally traced to the thyroid cartilage. The fold of mucous membrane over it constitutes the palato-pharyngeal fold or "posterior half arch."

Use.—To keep the soft palate in position during respiration. In deglutition, to elevate the pharynx; in order to make this action efficient, the palate must be elevated. The muscles then secure fixed points at their palatal connections, and assume a nearly vertical position. C. J. P. Yule[1] concludes, from observations on his own person, that the Palato-Pharyngeus is the chief factor in opening the Eustachian tube.

THE TENSOR PALATI.

This muscle arises from the sphenoid bone and the Eustachian tube. From the former it arises from the scaphoid fossa, and from the angular or spinous process. From the latter it arises from the hook cartilage. The fibres of both surfaces are at their origin contiguous, and form a small muscle which descends vertically to the end of the pterygoid process as far as the hamular process, around which its tendon turns to be distributed radially upon the aponeurosis of the soft palate. Some of its fibress are inserted upon the palatal bone.

Use.—This muscle, as its name expresses, was supposed to make the soft palate tense. This view is now no longer held. The muscle probably dilates the orifice of the Eustachian tube.

THE LEVATOR PALATI

arises from the end of the petrous portion of the temporal bone, and from the under surface of the Eustachian tube near its pharyngeal orifice. It receives some fibres from the cartilage of the tube. It is inserted into the soft palate near the uvula. The direction of the muscle is obliquely downward and inward.

Use.—With reference to the soft palate: The muscle elevates the soft palate and makes it tense, since the right and left muscles act synchronously. With reference to the Eustachian tube: The shortening of the body of the muscle, together with the increase of its diameter, has a tendency to close the orifice of the tube by elevating the lower border. The action of the Levator Palati can be readily studied in the living subject by the rhinal mirror. By such aid the course of the muscle, even when at rest, can be seen corresponding to an oblique fold of mucous membrane which may receive the name of the salpingo-palatal fold.

[1] Journ. of Anat. and Phys., viii. 1873; also Author's memoir on Soft Palate, Trans. Amer. Med. Assoc. 1872, 537.

The Levator Palati receives much attention in the improved operation of staphylorraphy. Fergusson, having noticed the influence of this muscle in widening the cleft in the soft palate, essays its division before uniting the freshened edges. This procedure is now an established antecedent to the operation.

The actions of the Levator Palati and Tensor Palati muscles have been the subject of controversy. Valsalva, as long ago as 1742, described both the above muscles as dilators of the tube. Toynbee,[1] in 1853, revived Valsalva's account; and later Rüdinger and other German writers have accepted this as the true action. Respecting the Tensor Palati, Henle[2] is inclined to adopt the view that the muscle closes the orifice; while, as seen in another part of the same volume (p. 117), he doubts the ability of the muscle to close the tube. His views upon the function of the Levator Palati agree with those expressed in the text.

The author has long taught that the contraction of the Levator Palati narrows the pharyngeal orifice of the tube. This action can be readily seen in the living subject by the aid of reflected light. Cleland[3] studied the action of the same muscles in a man who had lost the soft palate by ulceration. He doubts the efficacy of the Tensor Palati in dilating the tube, while he assigns to the Levator Palati its proper function, in assisting to narrow the orifice. That the Eustachian tube (*q. v.*) is always patulous in health, and that, while certain muscles tend to narrow its lumen, none can obliterate it, seem to be fair deductions from its nature.

THE AZYGOS UVULÆ.

The Azygos Uvulæ muscle is a slender slip arising from the posterior palatal spine and inserted into the free extremity of the uvula.

Use.—To contract the uvula.

The Salpingo-Pharyngeus is a small muscular slip passing from the cartilage of the Eustachian tube to the pharynx.

Use.—To assist the action of the Palato-Pharyngeus.

[1] Trans. Phil. Soc. Lond., 1853.

[2] Anatomie, ii. 755.

[3] Journ. of Anat. and Phys., iii. 1869, 97.

The Platysma Myoides.

The Platysma Myoides muscle is a thin quadrangular sheet arising from the subcutaneous connective tissue and from the fascia over the Pectoral, Deltoid, and Trapezius muscles. It passes upward and forward over the clavicle and the acromion to the lateral region of the neck to be inserted into the horizontal portion of the lower jaw in advance of the Masseter muscle. Some of the fibres pass further upward to be lost upon the face.

Use.—To elevate the skin over the chest, and then, being fixed, to depress the lower jaw. It doubtless also aids in making tense the superficial cervical fascia.

Remarks.—The two muscles tend to decussate at a point below the symphysis of the jaw.—The facial fibres, when inserted at the angle of the mouth, constitute the Risorius muscle.—Welcker[1] describes the muscle as arising from the lower jaw, and as being inserted directly into the skin over the front of the sternum and the lower part of the neck. He ascribes to it a function of elevating the skin over these parts.

Variations.—The acceptance of the Platysma as a rudiment of the Panniculus Carnosus, or the great subcutaneous muscle of quadrupeds, yields a clue to the variations of the muscle in the human subject. To rare instances of defect in development may be added frequent errors of excess by which slips from the muscle pass to one or more of the muscles of expression, the thyroid cartilage, the mastoid process, or the costal cartilages. Detached fascicles can be sometimes traced to the axilla.

Relations.—Above the muscle is the integument. Beneath, at the supra-hyoid region, lies the facial artery. A little farther down lie the external jugular vein, its tributaries, and the ascending superficial branches of the cervical plexus. Above the clavicle lie the termination of the external jugular vein, and the descending superficial branches of the cervical plexus. Separated by the layer of the cervical fascia are the superficial cervical lymphatics and the Sterno-Cleido-Mastoideus muscle.

[1] Zeitschr. für Anat. und Entwickelungsgesch., i. 1876, 198, fig.

EXPLANATION OF PLATE XLV.

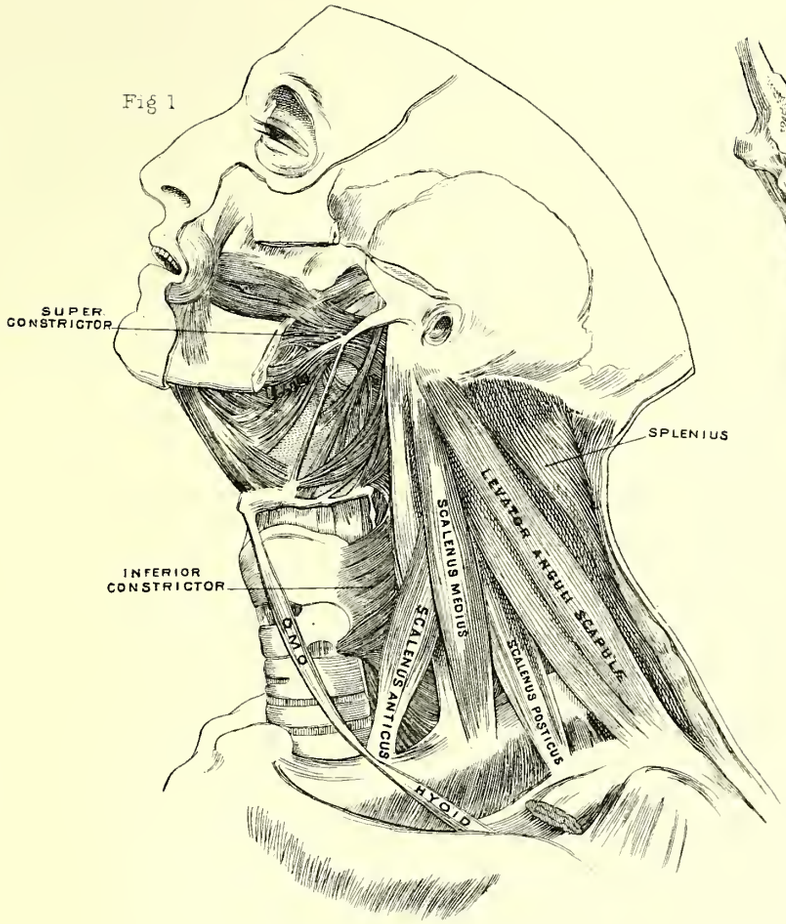
Fig. 1. The deep muscles of the neck, and the muscles of the pharynx in part.

Fig. 2. The muscles of the pharynx, seen from behind.

Fig. 3. The muscles of the neck, attached to the vertebræ.

PLATE XLV

Fig 1



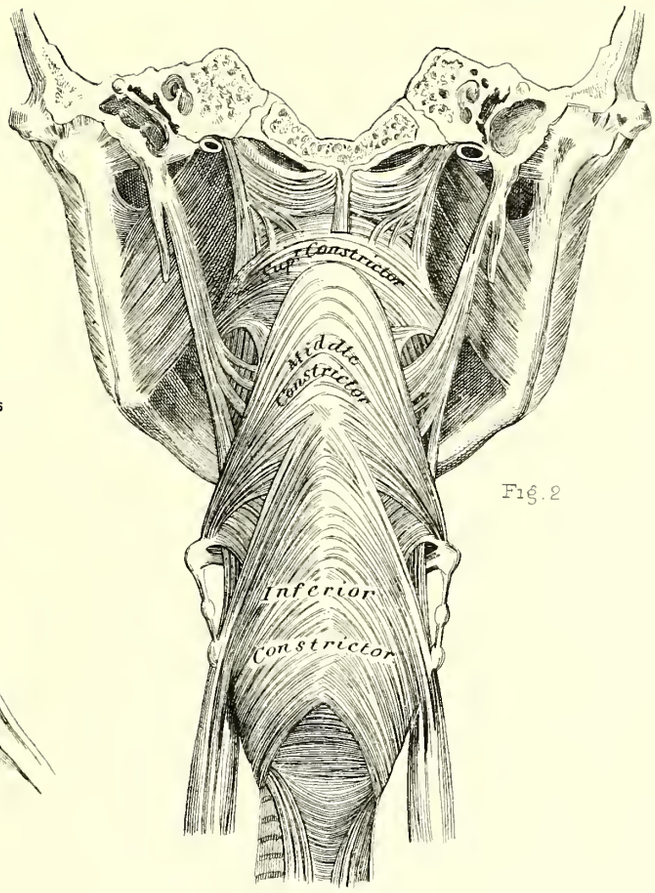
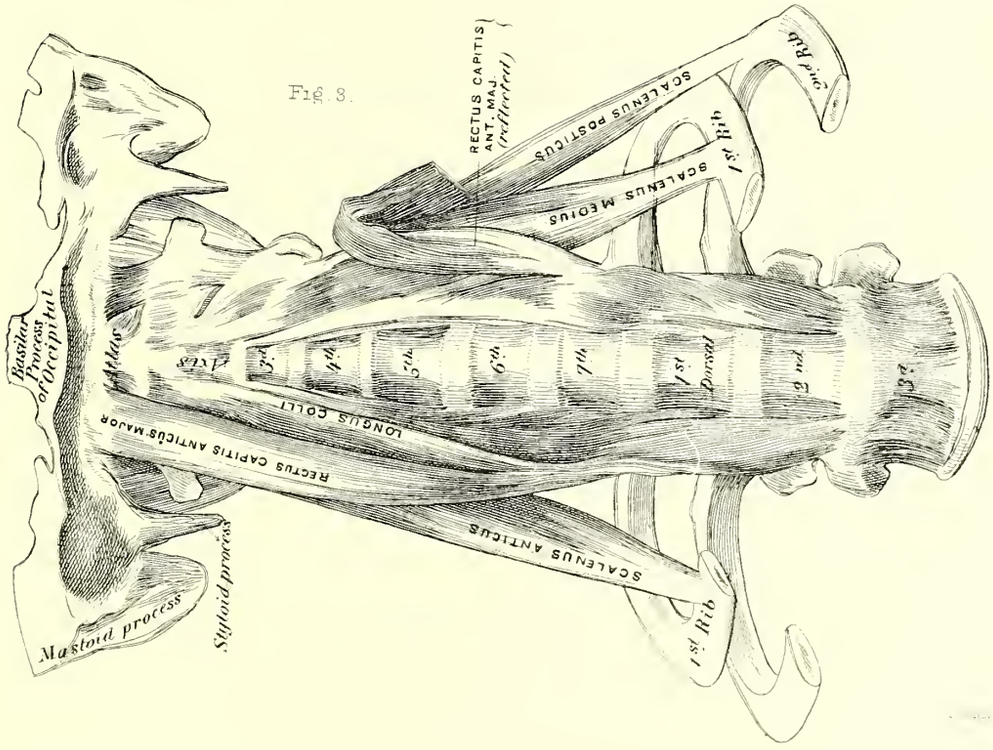


Fig. 2

Fig. 3.



The Sterno-Cleido-Mastoideus.

The Sterno-Cleido-Mastoideus muscle arises by two heads: the one from the anterior border of the upper end of the sternum, the other from the sternal end of the clavicle. It passes upward and outward, forming a large sub-rounded belly to be inserted into the mastoid process. It is composed of two laminæ united at the anterior border.

Use.—To bring the head forward in the nodding position when both muscles act together, or to bring the head downward and to one side, and to rotate it when one muscle acts singly. Each muscle may assist in actions of the anterior and the posterior set of cervical muscles. The head being fixed, the muscle becomes an accessory muscle of respiration by assisting in elevating the thorax. It also serves to fix the clavicle.

Nerves.—The muscle is supplied by the cervical plexus and by the spinal accessory.

Relations.—To its outer side is the external jugular vein. The superficial branches of the cervical plexus of nerve escape at its outer border. The auricularis magnus and the superficial cervical nerves are conspicuous in crossing the muscle. At the upper posterior border the occipitalis minor nerve ascends to the occiput, while the sternal and clavicular branches are apt to cross the muscle obliquely on their way to the thorax. The spinal accessory nerve pierces the posterior border. Beneath the muscle lie the Splenius Capitis, the Omo-Hyoid muscle, the Digastric and Stylo-Hyoid muscles, and a portion of the Sterno-Hyoid and Sterno-Thyroid muscles. Over it is the Platysma Myoides muscle. It is intimately held to the superficial fascia and integument at its insertion. The anterior border overlies the parotid gland.

Variations.—The muscle may be separated into two distinct portions. The two heads are rarely fused. The sternal head may be duplicated. Slips may pass to the lower jaw (constant in the horse) and to the stylo-maxillary ligament. The sternal head may pass down on the sternum a variable distance. Gruber[1] identifies a fascicle which passes down the entire length of the sternum as belonging to this head. Slips of the same head may overlie the Pectoralis Major and the cartilages of the true ribs. A separate group of muscles placed between it and the muscles on the back of the neck are thought to be variations of the Sterno-Cleido-Mastoideus. Such are independent bundles from the occiput and the cervical vertebræ to the clavicle, or a slip from the cervical vertebræ to the acromion. These tend to fuse with the Trapezius and to be compensatory with the Levator Anguli Scapulæ.

[1] Mém. de l'Acad. des Sciences, St. Petersbourg, 1860, 3.

Remarks.—This muscle in contracting causes a pouch to form in the superficies of the neck at its lower part, between the trachea and the deep fascia. Erichsen[1] calls especial attention to this in describing tracheotomy. Instances have been known where the tracheal tube was thrust into this pouch, the operator believing that it was in the trachea.

Whenever the deep-seated lymphatics at the base of the neck become enlarged, the tumor is formed behind the posterior belly of the Omo-Hyoid muscle, is bound down by it and the fascia, continues for a length of time unchanged in appearance. At last it is protruded outwardly, pushing before it the Omo-Hyoid, by which the acromial margin of the Sterno-Mastoid is turned forward, and its clavicular portion pulled up on the side of the tumor and carried away from the sternal part. This position of the Sterno-Mastoid depends on its connection with the Omo-Hyoid. When, therefore, the Sterno-Mastoid is seen pulled over a tumor situated between that muscle and the Trapezius, the surgeon may be certain that it is deeper than the Omo-Hyoid.[2]

This muscle is sometimes ruptured in childbirth.[3]—It was found by Canton[4] exceedingly tense in luxation of the sternal end of the clavicle. There was no rupture of its fibres—a condition which, according to Nélaton, notably occurs in those cases in which the sternal end is inserted beneath the articulation itself.—Induration of a peculiar character is occasionally met with in this muscle in new-born children. It appears to be an obscure form of local swelling directly in the substance of the muscle.

The Depressors of the Hyoid Bone (fig. 2, Plate XLIV.; fig. 1, Plate XLV).

These include—

The Sterno-Hyoid.
The Sterno-Thyroid.
The Thyro-Hyoid.
The Omo-Hyoid.

THE STERNO-HYOID.

The Sterno-Hyoid muscle arises from the posterior surface of the sternum near its free upper border. It passes upward as a ribbon-shaped mass, having straight fibres to be inserted into the body of the hyoid bone to the median side of the Omo-Hyoid muscle.

[1] Surgery, 916.
[2] Burns, Surg. Anat., 77.
[3] Wm. Smith, Trans. Clin. Soc., iv. 70.
[4] Lancet, Sept. 15, 1860, 264.

Use.—To depress the hyoid bone.

Relations.—This muscle is covered with the sternum below, and with the Platysma and the Sterno-Cleido-Mastoid above. Below lie the Sterno-Thyroid and the Thyro-Hyoid muscles, as well as a branch of the superior thyroid artery. To its inner border lies the muscle of the opposite side. These muscles, however, are not in contact, save at a small surface.

The origin of the Sterno-Hyoid muscle exhibits frequent Variations, which are due to its extension behind the sterno-clavicular articulation, or to the clavicle. The posterior surface may be marked by a transverse tendinous inscription.

THE STERNO-THYROID.

The Sterno-Thyroid muscle arises from the posterior surface of the sternum and the first rib, and passes upward to be inserted into the oblique line on the side of the thyroid cartilage. It is somewhat broader than the Sterno-Hyoid muscle, but resembles it in its general features.

Use.—To depress the thyroid cartilage, and indirectly the hyoid bone.

Relations.—Beneath the muscle, at its origin, often lies a branch of the superior thyroid artery. Below it are the trachea, the thyroid body, and the thyroid cartilage. Above it are the sternum, the Sterno-Hyoid, and the Sterno-Cleido-Mastoid muscle in part. To its inner side, near the sternum, it is in contact with the muscle of the opposite side in front of the trachea. The upper part of the muscle is firmly held in place by fascia; but the lower part, near the sternum, is surrounded by connective-tissue of loose texture. To the outer side is the internal jugular vein. According to Quain, slips may pass to the Thyro-Hyoid muscle or to the inferior constrictor of the pharynx. Like the Sterno-Hyoid, the Sterno-Thyroid is often marked by a transverse tendinous line.

THE THYRO-HYOID.

The Thyro-Hyoid muscle arises from the oblique line of the thyroid cartilage, and passes upward to be inserted into the hyoid bone at the body and at the greater cornu.

Use.—To raise the thyroid cartilage, or, when the thyroid is fixed, to depress the hyoid bone.

Relations.—Above, the muscle is covered by the Sterno-Hyoid and the Omo-Hyoid muscles. Below it are the thyroid cartilage and the thyro-hyoid membrane. Passing beneath it to effect entrance into the larynx through the thyro-hyoid membrane are the superior laryngeal nerve and artery.

Variation.—Gruber[1] describes a slip passing from the surface of the thyroid cartilage to the trachea.

[1] Bull. de l'Acad. Imp. St. Petersbourg, 1861, 154.

THE OMO-HYOID.

The Omo-Hyoid muscle arises from the upper border of the scapula, near the supra-scapular notch. It passes upward and forward, and is inserted into the hyoid bone at the lower border of the body. It is a thin slender muscle, and is remarkable for exhibiting a central tendon, which separates the muscle, more or less distinctly, into two bellies. The tendon is held in a loop of deep fascia, and lies behind the Sterno-Cleido-Mastoid muscle.

Relations.—Anterior belly: Above lies the Platysma. Beneath are the Sterno-Hyoid, and a branch of the superior thyroid artery and vein. Posterior belly: Above are the Trapezius, the Subclavius, the clavicle, and the Sterno-Cleido-Mastoid muscle. Beneath are the Scaleni, the brachial plexus in part, the sheath of the great vessels, the descending branch of the hypoglossal nerve, and the Sterno-Thyroid muscle. At its insertion the Omo-Hyoid lies to the outer side of the Sterno-Hyoid muscle.

Burns[1] narrates a case where destruction of the depressors of the hyoid bone by suppuration caused such pressure upon the trachea during inspiration as to interfere with respiration. The trachea, the innominate artery, and the thyroid branch of the lower thyroid artery were found to be covered merely by a thin pellicle of skin.

Variations.—The muscle may undergo cleavage throughout or in part. It may be absent, or one belly alone be present. It may fuse with the Sterno-Hyoid. It may receive an accession from the clavicle. The line of origin may be shifted forward to the coracoid process or to the first rib. An independent slip may extend from the hyoid bone to the clavicle.[2]

The Deep Lateral and the Prevertebral Muscles of the Neck.

These embrace the following:—

- The Deep Lateral.
  - Scalenus Anticus.
  - Scalenus Medius.
  - Scalenus Posticus.
- The Prevertebral.
  - Rectus Capitis Anticus Major.
  - Rectus Capitis Anticus Minor.
  - Rectus Capitis Lateralis.
  - Longus Colli.

THE SCALENI MUSCLES.

These extend from the cervical vertebræ to the first and second ribs. They are three in number: the Anterior, the Middle, and the Posterior.

[1] Surgical Anatomy, 36.

[2] Gruber, Bull. de l'Acad. St. Petersbourg, 1872, 158.

The Scalenus Anticus muscle arises from the anterior tubercles of the transverse processes of the cervical vertebræ from the third to the sixth. It passes downward to be inserted into the first rib at a tubercle in advance of the subclavian groove.

Relations.—The muscle lies to the outer side of the Longus Colli and the Rectus Capitis Anticus Major. To its outer side emerges the cervical plexus of nerves. Behind it lies the subclavian artery, while in front lies the subclavian vein. The muscle is crossed by the phrenic nerve obliquely from without inward, while the Omo-Hyoid crosses it from below upward and inward.

The muscle is sometimes pierced by the subclavian artery. In such an instance Albinus described the posterior fasciculus as the Scalenus Minimus.

The Scalenus Medius muscle arises from the posterior tubercles of the transverse processes of all the cervical vertebræ excepting the atlas. It passes downward to be inserted into the first rib at the upper border and the posterior surface.

Hyrtl gives the origin of this muscle from all the transverse processes.

Relations.—The Anterior Scalene lies in front of the Posterior Scalene, and the Levator Anguli Scapulæ behind it. Between the two Scalene muscles is a triangular space occupied by the subclavian artery and the brachial plexus of nerves.

The Scalenus Posticus muscle arises from the posterior tubercles of the transverse processes of the last three cervical vertebræ. It passes downward to be inserted into the outer surface of the second rib between its tubercle and the angle, directly in advance of the insertion of a digitation of the Serratus Magnus.

Variations.—The Scalene muscles are compensatory with one another; they may fuse with one another. They may range in origin along all the transverse processes of the cervical vertebræ, the seventh alone excepted. One may be absent.—The Scalenus Anticus may fuse with the Rectus Capitis Anticus Major. It may be pierced by the phrenic nerve.—The Scalenus Posticus may send a slip to the Levator Anguli Scapulæ. It may undergo longitudinal cleavage, and be inserted into the first, second, and third ribs.

Use.—To raise the ribs upon which they are inserted. Henle compares the Scalenus Anticus and Scalenus Medius to the intercostal muscles, since they are in contact with the pleura, assist in closing the superior thoracic aperture, and assist in protecting the chest wall at its upper part.—Slips of the Scalene group, apparently detached from one of the above-named muscles, have received the names of Scalenus Lateralis, Scalenus Minimus, and Scalenus Accessorius.

THE RECTUS CAPITIS ANTICUS MAJOR

arises from the anterior tubercles of the transverse processes of the cervical vertebræ from the third to the sixth. It ascends inclining slightly toward the median line, and is inserted upon the basilar process of the occipital bone.

Variations.—It may fuse with the Longus Colli, and in part with the Scalenus Anticus. Its slips of origin are variable in a range from the second to the fifth.

THE RECTUS CAPITIS ANTICUS MINOR

arises from the transverse process and anterior arch of the atlas. It passes upward and inward beneath the preceding, and is inserted into the basilar process.

Variations.—It may be absent, or undergo longitudinal cleavage. A fascicle may join the preceding muscle.

THE RECTUS CAPITIS LATERALIS

extends from the transverse process of the atlas to the jugular process of the occipital bone. It is homologous with the Intertransverse muscles of the vertebral column.

Uses.—The greater and the lesser Recti muscles incline the head forward and slightly rotate it. They antagonize the muscles on the back of the neck.

THE LONGUS COLLI.

The Longus Colli consists of three portions: a median, a superior, and an inferior oblique.

The median portion arises from the body of the axis, and passes downward in a nearly straight line to be inserted into the bodies of the third and fourth dorsal vertebræ.

The superior oblique portion arises from the tubercle of the atlas, and is inserted into the anterior tubercle of the transverse process of the third and fourth cervical vertebræ.

The inferior portion arises from the second and third dorsal vertebræ, and is inserted into the anterior tubercles of the transverse process of the sixth and seventh cervical vertebræ.

Use.—The Longus Colli bends the neck forward when the median fibres, or to one side when the lateral fibres contract. It may also slightly rotate the cervical vertebræ.

Variations.—The muscle may be thin or rudimentary. It may send fibres to the head of the first rib.

THE CERVICAL FASCIA.

The soft parts of the neck are held together by fascia and intermuscular septa, which present some peculiarities. At the back of the neck, and for the most part at the sides, the fleshy and fibrous elements are compactly adapted to one another and to the vertebræ. At the front the case is different: Here the lower jaw, the respiratory apparatus and its associated muscles, the Sterno-Cleido-Mastoideus muscle, the great vessels as well as the movable boundaries of the superior thoracic aperture, all permit considerable latitude of motion. The disposition of the fascia to facilitate this motion, and at the same time to afford protection to the vessels and nerves of the neck, is sufficiently striking to demand a separate section for its consideration.

The fascia of the front of the neck forms many layers, of which may be mentioned the following:—

(1) A superficial layer in which is incorporated the Platysma Myoides. It is continuous with the superficial fascia on the chest and with the fascia of the superior extremity.

(2) Two layers, in the space between which is inclosed the Sterno-Cleido-Mastoideus muscle. These layers are for the most part thin, and allow the muscular fibres to be seen through them. Above, near the angle of the jaw, they become thicker and are more adherent to the muscle than elsewhere. On either side of the muscle the two inclosing layers unite: The inner passes inward to cover in the great vessels, and the Sterno-Hyoid, the Sterno-Thyroid, and the anterior belly of the Omo Hyoid muscles. The outer lies over the origin of the brachial plexus and over the origin of the Scalene muscles; it contains some adipose tissue, small veins, and lymphatic glands. At the anterior margin of the Trapezius muscle it again divides to inclose this muscle, and is lost on the back.

(3) The layer inclosing the lower belly of the Omo-Hyoid (Omo-Hyoid fascia). This is a rather stout fascia which passes over the muscle down to the first rib. Upon this layer the intermediate tendon of the Omo-Hyoid is secured.

(4) The sheath of the great vessels and the pneumogastric nerve. This is somewhat distinct from the preceding, as is the connective tissue in front of the cervical vertebræ.

(5) The fascia associated with the depressors of the hyoid apparatus. This can be traced downward into the thorax, and thence as far as the pericardium (cervico-pericardial aponeurosis of Godman), and exerts, it is thought, slight influence in suspending the heart.

(6) The layers inclosing a space about the position of the submaxillary salivary gland, the associated lymphatic gland, and stretching between the intermediate tendons of the Digastric muscles. The lateral border of the inter-digastric layer coincides with the level of the Sterno-Cleido-Mastoid muscle.

This division of the fascia is sometimes called the *supra-hyoid aponeurosis.* Its position corresponds to that of a sheet of muscular fibre belonging to the Digastric muscles in some of the lower animals. In the variations of the Digastric in man, slips of contribution are described passing over this aponeurosis to the Mylo-Hyoid muscle.

Remarks.—The medical relations of the cervical fascia are numerous and important. The following comments, with cases, will doubtless prove of interest.

Abscess above or in the superficial layer has no disposition to burrow, no matter how extensive a surface it may occupy.—In the space above the clavicles, between the Sterno-Cleido-Mastoid muscles, abscess sometimes forms at a point midway between the prevertebral and the superficial localities. This space is occupied with fat, with the common trunk of the anterior jugular and median jugular veins, and occasionally with a small lymphatic gland. It communicates with a recess behind the Sterno-Cleido-Mastoid muscle carrying the transverse cervical vein. The pus in this space inclines by gravity to extend behind the sternum.—The case is far different in an abscess situate between the fascia inclosing the Sterno-Cleido-Mastoid and that inclosing the Omo-Hyoid muscle. The pus here is inclined to follow the plane of the posterior belly of the Omo-Hyoid muscle to the first rib, and thence to the axilla.—Should an abscess occupy the space between the Omo-Hyoid fascia and that of the great vessels of the neck (often described as the space between the second and the third layers), the pus is inclined to pass downward along the course of the jugular vein, or inward about the trachea or œsophagus, or somewhat laterally toward the back of the neck.

Abscess in the prevertebral space is either formed about the deep cervical lymphatic glands found in that position, or gravitates thence from behind the pharynx. Should there be no point of softening to serve as a guide, the incision for relief should be made parallel to the outer border of the Sterno-Cleido-Mastoid muscle. The great vessels are liable to be displaced by such a collection to a remarkable degree. A careful dissection should be made, and the director

or probe should be used to separate the matted tissues below the well-defined layers of fascia.

In a case of fracture of the right clavicle, under the care of Erichsen,[1] a red and œdematous swelling, which was noticed at the base of the neck, filled up the supra-clavicular depression and overlapped the prominence of the bone. Such involvement of the connective tissue of the neck from injuries to the clavicle is rare.

J. W. Cusack[2] describes a tumor which occupied the supra-hyoid space, and extended thence below to the thyroid cartilage and above to the left ear. The mass had displaced the submaxillary gland upon the jaw, and pushed the Digastric and Stylo-Hyoid muscles upward, and the external carotid artery outward. It also involved the greater cornu of the hyoid bone and the hypoglossal nerve. In its removal the external carotid artery was ligated, and the hypoglossal nerve cut through. The patient recovered with atrophy and paralysis of the corresponding side of the tongue.

Abscess of the upper part of the neck, namely, from the hyoid bone upward, has an inclination to pass directly backward and involve the base of the tongue and the region of the epiglottis.[3] Two cases are given by G. Buck,[4] in which the corresponding half of the epiglottis, together with the aryteno-epiglottidean fold, became involved from such an abscess. In one of these patients death ensued from œdema of the glottis.

Mohrenheim's fossa is the name given to the depression above the clavicle to the outer side of the Sterno-Cleido-Mastoideus muscle. The subclavian artery can be compressed against the first rib at this point. Incision or the exploration of sinuses, in this region, should be made with caution. The numerous small veins bleed freely, owing probably to their cut ends being made patulous by their connection with the cervical fascia.

III. THE MUSCLES OF THE TRUNK.

The muscles of the trunk[5] embrace—

The Muscles of the Back.
The Muscles of the Thorax.
The Diaphragm.
The Muscles of the Abdomen.

The Muscles of the Back.

The best arrangement of the muscles of the back is that based upon their functions.

In the first group is embraced the great Erector Spinæ muscle, including in this term the Sacro-Lumbalis, Longissimus Dorsi, Spinalis Dorsi, Transversalis Cervicis, Musculus Accessorius, and Ascendens Cervicis.

In the second group are the muscles arising from the vertebræ and inserted into the ribs. These embrace the Levatores Costarum, the Serratus Posticus Superior, and the Serratus Posticus Inferior.[1]

In the third group may be placed the muscles passing between the vertebræ, and those passing between the vertebræ and the skull. Four kinds of motion are here recognized: the backward, forward, lateral, and rotatory. The muscles effecting the *backward* movement (or extension) are the Splenius Colli, Interspinales, Rectus Capitis Posticus Minor, and Rectus Capitis Posticus Major; those effecting the *forward* movement (flexion) are the Longus Colli, Psoas,[2] Rectus Capitis Anticus Minor, Rectus Capitis Anticus Major; those effecting the *lateral* movement are the Intertransversales, the Rectus Capitis Lateralis, the Trachelo-Mastoid; those effecting the *rotatory* movement are the Rotatores Spinæ, Multifidus Spinæ, Semispinalis, Obliquus Capitis Inferior, Obliquus Capitis Superior, Complexus, and Splenius Capitis.[3]

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[1] Lancet, Dec. 24, 1870.

[2] Dublin Hospital Reports, i., 1818, 205.

[3] R. W. Smith, Dub. Quart. Journ., 1846, i. 553.

[4] N. Y. Med. Journ., 1866, ii. 36.

[5] In a classification of muscles based upon physiological considerations, the muscles of the trunk do not include those of the perineum, some of which belong to the alimentary canal, and others to the genito-urinary apparatus. It will nevertheless be seen that the muscles of the perineum lie within the trunk, which is defined as that portion of the body which remains when the head, neck, and limbs are removed—the *torso* of the artist.

[1] The Scaleni have arbitrarily been considered among the muscles of the neck. Their true position is in the second group as above indicated. In like manner the anterior portion of the Quadratus Lumborum may be placed in this group.

[2] Conventionally included in the muscles of the lower extremity.

[3] This classification is essentially that of G. Hermann Meyers (Lehrbuch der Anatomie des Menschen, Leipzig, 1855–73), and Theile (Müller's Archiv. für Anat., 1839, p. 102, fig.), and, as far as the first group is embraced therein, that of Joseph Leidy (An Elementary Treatise of Human Anatomy, Philadelphia, 1861).

Anatomists have not agreed upon a uniform plan for arranging the muscles of the back. The English writers divide them into layers—a purely artificial classification, and designed only to facilitate the task of their dissection. Five layers are by them named as follows:—

The *First Layer* is composed of the

Trapezius.	Latissimus Dorsi.

The *Second Layer* of the

Levator Anguli Scapulæ.	
Rhomboideus Major.	Rhomboideus Minor.

The First Group of muscles includes the Erector Spinæ and its subdivisions.

THE ERECTOR SPINÆ.

The Erector Spinæ consists of two portions—a median and a lateral. The median portion is called the Longissimus Dorsi, and the lateral the Sacro-Lumbalis.

The Longissimus Dorsi arises from the spines of the saerum and the spines of the lumbar vertebræ, as well as from the lower and back part of the sacrum. It is inserted by serrate slips into the posterior ends of the ribs (exeepting the first and last) near their tubercles, and into the transverse proeesses of the lumbar vertebræ.

The Saero-Lumbalis (more properly ealled the Ileo-Costalis) arises by fleshy fibres from the outer fifth of the crest of the ilium, and is inserted by serrate slips into the inferior border of each rib, near the angle.

The subdivisions of the Ereetor Spinæ embraee—

The Spinalis Dorsi.
The Transversalis Cervieis.
The Musculus Accessorius.
The Aseendens Cervicis.

The Spinalis Dorsi is a long narrow muscle sometimes deseribed as distinct from the Longissimus. It extends from the spines of the first two lumbar and the two lowest dorsal vertebræ, and is inserted into from four to eight of the higher dorsal spines.

Under the name of the Transversalis Cervicis the Longissimus sends a cervical slip from the transverse proeesses of the fourth and fifth dorsal vertebræ to the posterior tuberele of the transverse proess of each of the eervical vertebræ exeepting the first and the seventh. The Transversalis Cervicis may seeure slips of origin from the two lower cervieal vertebræ.

The Museulus Accessorius and Aseendens Cervicis are aeeessory cervical slips analogous to the Transversalis Cervicis. They pass upward from the upper five or six ribs to the transverse proeesses of the third or the fourth cervical vertebra.

The Longissimus Dorsi is apparently united by fibrous tissue to the crest of the ilium. It effects a slight union with the lumbar fascia.

When the Ereetor Spinæ is removed, the Posterior Inferior Serratus, and the deep layer of the aponeurosis are exposed. The latter is known as *the posterior layer of the lumbar fascia.* It extends from the transverse proeesses of the lumbar vertebræ between the last rib and the erest of the ilium. It affords fibres of attachment to the Longissimus Dorsi, and covers in the Quadratus Lumborum muscle.

The *anterior layer of the lumbar fascia* is best seen from within the abdomen. It is in relation with the prevertebral region. It serves as the faseial covering of the anterior surfaee of the Quadratus Lumborum, and is continuous above with the *ligamenta arcuata* of the Diaphragm.

Use.—When both act, to extend the spine. When one musele acts separately, particularly when the Longissimus Dorsi eontracts, to draw the vertebral eolumn to one side.

Variation.—The Erector Spinæ is subject to slight and unimportant variations.

The Vertebral Aponeuroses.—The Vertebral Aponeuroses is the name given to a system of membranous layers attaehed to the vertebræ and serving to define the relations between the muscles of the baek. When the skin of the lumbar region is removed, the *superficial layer* of the aponeurosis or dorso-lumbar fascia is exposed. This layer is a beautiful glistening membrane occupying the interval between the sacral and lumbar spines and the crest of

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The *Third Layer* of the

Serratus Posticus Superior.	Splenius Capitis.
Serratus Posticus Inferior.	Splenius Colli.

The *Fourth Layer* of the
Erector Spinæ and its subdivisions

The *Fifth Layer* of the

Semispinalis Dorsi.	Extensor Coccygis.
Semispinalis Colli.	Intertransversales.
Multifidus Spinæ.	Rectus Posticus Major.
Rotatores Spinæ (Supra Spinales).	Rectus Posticus Minor.
	Obliquus Superior.
Interspinales.	Obliquus Inferior.

Hyrtl arranges the muscles into three groups according to their shapes: the Broad, the Long, and the Short.

The *Broad Muscles* embrace the

Trapezius.	Serratus Posticus Superior.
Latissimus Dorsi.	Serratus Posticus Inferior.
Rhomboideus.	Splenius.
Levator Anguli Scapulæ.	

The *Long Muscles* embrace the

Erector Spinæ.	Semispinalis Dorsi (Spinalis Cervicis, Semispinalis Cervicis).
Complexus.	
Spinalis Dorsi.	

The *Short Muscles* embrace the

Multifidus Spinæ.	Rectus Capitis Posticus Minor.
Interspinales.	Rectus Capitis Posticus Laterale.
Intertransversales.	Obliquus Capitis Minor.
Rectus Capitis Posticus Major.	Obliquus Capitis Major.

Henle defines first a superficial group of sheath-like muscles passing from the spinous processes outward. It includes the Trapezius, Rhomboideus, Latissimus Dorsi (with Teres Major), the two posterior Serrati, and Splenius. He includes in his second group all the remaining muscles.

the ilium. It is seen to give origin to the Latissimus Dorsi muscle, and to protect and in part give origin to the Erector Spinæ. When the extrinsic muscles of the superior extremity and the Posterior Superior Serratus muscles are removed, it is seen to pass upward, covering in the Erector Spinæ and the Splenius muscles, while affording origin to the Inferior Posterior Serrate muscle. It here constitutes the vertebral aponeurosis of the English writers.

The Second Group of muscles of the back embraces—

The Levatores Costarum.
The Serratus Posticus Superior.
The Serratus Posticus Inferior.

THE LEVATORES COSTARUM.

The Levatores Costarum arise from the tuberosity and the transverse processes of the last cervical vertebra, and from the transverse processes of all the dorsal vertebræ but the twelfth. The fibres pass downward and outward in each case to the upper border and the posterior surface of the rib next below between the tubercle and the angle.

Use.—To elevate the ribs.

Variation.—Each muscle is inclined to undergo longitudinal cleavages, by means of which the superficial fibres are the longer, and are inserted into the second rib below the origin, while the deeper fibres reach to the rib directly below the origin.

Some fibres of the Levatores Costarum, namely, on the four last ribs, pass from the transverse process of the seventh dorsal vertebra to the ninth rib, and from the transverse process of the tenth dorsal vertebra to the twelfth rib. These are often called the Levatores Costarum Longiores. The Levatores Costarum are supposed to be specially differentiated slips of the external intercostal series of muscles.

THE SERRATUS POSTICUS SUPERIOR.

This muscle arises from the lower part of the ligamentum nuchæ, from the spines of the sixth and the seventh cervical vertebræ, and from the spines of the first and the second dorsal vertebræ. Its origin is aponeurotic. It is inserted by four digitations into the ribs from the second to the fifth.

Use.—To raise the ribs.

THE SERRATUS POSTICUS INFERIOR.

This muscle is larger than the preceding, and lies beneath the Latissimus Dorsi. It arises from the lumbar aponeurosis in the region of the tenth to the twelfth dorsal vertebra, and the upper lumbar vertebræ. It passes as a broad thin fleshy sheet upward and outward to be inserted into the lower borders of the eighth to the twelfth ribs.

Use.—To depress the ribs.

Variation.—The muscle may fuse with the Latissimus Dorsi.

The Third Group is composed of—

The Extensors.
- Splenius Colli.
- Interspinales.
- Rectus Capitis Posticus Major.
- Rectus Capitis Posticus Minor.

The Flexors.
- Longus Colli.[1]
- Rectus Capitis Anticus Minor.
- Rectus Capitis Anticus Major.

The Lateral Tractors.
- Intertransversales.
- Rectus Capitis Lateralis.
- Trachelo-Mastoid.

The Rotators.
- Splenius Capitis.
- Complexus.
- Obliquus Capitis Superior.
- Obliquus Capitis Inferior.
- Semispinales Colli et Dorsi.
- Multifidus Spinæ.

SPLENIUS CAPITIS ET COLLI.

The Splenius muscle arises from the spines of the fifth, sixth, and seventh cervical vertebræ, and the spines of the dorsal vertebræ as far as the third or fourth. Its fibres pass upward and outward, and divide ordinarily into two sets of fasciculi. The lower fasciculus is inserted into the transverse processes of the second and third cervical vertebræ; while the upper is inserted into the skull at the mastoid process and the superior semicircular line.

For convenience the two divisions of the Splenius are described together. The functional differences between the cervical and occipital portions should, however, be borne in mind.

Use.—In part to turn the head and neck. Acting with the more superficial muscles at the nape of the neck, the Splenius can extend the head on the spine, and extend the cervical portion of the spine.

Variations.—Sometimes the two divisions are not apparent. A slip is often derived from the lower division, which is identical with the Levator Anguli Scapulæ.—A slip may be traced to the occipital bone and the mastoid process of the temporal bone.

[1] The Longus Colli is described on p. 263.

Relations.—Above it lie the Trapezius, Rhomboid, and Serratus Posticus Superior. At the skull it lies beneath the thin aponeurotic tendon of the Sterno-Cleido-Mastoideus. Below it are the Complexus and Trachelo-Mastoid muscles.

The anterior border of the Splenius Capitis may be mistaken for a cervical lymphatic gland.

THE INTERSPINALES.

These are short symmetrical bundles lying between the spinous processes of the vertebræ, the spaces between the processes of the third and the tenth dorsal alone excepted. They are best developed in the neck.

Slips pertaining to the Interspinales are seen in the cervical region overlying the spinous processes. These have received the name of the Supraspinales.

Use.—To aid in extending the vertebræ.

THE RECTUS CAPITIS POSTICUS MAJOR.

This arises from the spine of the axis, and passes obliquely upward and outward to be inserted into the inferior semicircular line of the occipital bone.

It is homologous with an Interspinalis.

Use.—To aid in extending the vertebræ.

THE RECTUS CAPITIS POSTICUS MINOR.

This lies beneath the Rectus Capitis Posticus Major. It arises from the posterior tubercle of the atlas, and is inserted into the inferior semicircular line of the occipital bone.

It is analogous to an Interspinalis muscle or Semispinalis Colli.

Use.—To aid in extending the vertebræ.

THE INTERTRANSVERSALES.

These are short vertical muscles, passing between pairs of adjoined transverse processes. An anterior and a posterior slip are recognized. They are best developed in the cervical region, and least so in the dorsal, where in the upper portion they are absent.

Use.—To aid in lateral traction of the spine.

The anterior slips may be said, strictly speaking, to connect the transverse processes; the posterior are associated with the oblique processes.

The Extensor Coccygis of lower animals appears to be composed of excessively developed elements of the Intertransversales.

RECTUS CAPITIS LATERALIS.

The Rectus Capitis Lateralis arises from the free end of the transverse process of the atlas, and is inserted into the jugular process of the occipital bone.

Use.—To aid in lateral traction of the head on the spine.

THE TRACHELO-MASTOID.

This muscle arises from the transverse and articular processes of the four lower cervical vertebræ and the three upper dorsal vertebræ, ascends directly upward, and is inserted upon the mastoid process.

Use.—To draw the head backward and to rotate it.

Variation.—It is often fused with the Transversalis Cervicis.

THE COMPLEXUS.

The Complexus muscle arises from the transverse processes of the four lower cervical and the three upper dorsal vertebræ, as well as from the articular processes of the cervical vertebræ from the third to the sixth. A slip situated at its median margin, and usually marked by a transverse inscription, is often described as a separate muscle under the name of Biventer Cervicis.

Use.—To rotate the spine at the cervical region.

The origin of the muscle may include the dorsal spines as far down as the seventh.

Variations.—The Complexus may in part fuse with the Trachelo-Mastoid or the Longissimus Dorsi.

THE OBLIQUUS CAPITIS SUPERIOR

arises from the tips and upper surface of the transverse process of the atlas, and passes obliquely upward and inward to be inserted into the occipital bone at the inferior semicircular line.

Use.—To aid in rotating the vertebræ.

THE OBLIQUUS CAPITIS INFERIOR

arises from the spinous process of the axis, and passing obliquely upward and outward is inserted into the transverse process of the atlas.

Use.—To aid in rotating the vertebræ.

THE SEMISPINALIS COLLI.

The Semispinalis Colli extends from the transverse processes of the first four or five dorsal vertebræ, and is inserted into the spines of the cervical vertebræ from the second to the fifth.

Use.—To aid in rotating the cervical vertebræ.

THE SEMISPINALIS DORSI.

The Semispinalis Dorsi arises from the transverse processes of the dorsal vertebræ from the fifth to the tenth, and is inserted into the spines of the last two cervical vertebræ and the first to the fourth dorsal vertebræ.

Use.—To aid in rotating the cervical vertebræ.

THE MULTIFIDUS SPINÆ.

The several bundles of the Multifidus Spinæ arise from the articular and transverse processes of the vertebral column from the sacrum to the axis, and are inserted into the spinous processes. They are short, and each may include simply the distance from its origin to the spine of the next vertebra above. Many, however, pass to the second or third spine. Compared with the size of the muscle the quantity of fibrous tissue within it is unusually great.

In the sacral region fasciculi arise from the groove on the back and the lateral sacral crest; in the lumbar, from the mammillary processes; in the dorsal, from the transverse processes; and in the cervical, from the articular processes of the four lower vertebræ.—A deeper set, which is developed in the dorsal region, and which passes from the transverse processes to the laminæ of the vertebræ above, has received the name of the Rotatores Spinæ.

Use.—To aid in rotating the vertebræ.

Remarks.—The post-cervical muscles when divided, as by a sabre-cut, allow the head to sag forward, and the chin to rest upon the sternum as remarked by Larrey.[1] It follows that, in order to preserve the rest necessary to secure union between the lips of such a wound, the head must be supported in an upright position.

The tension of the muscles of the back has been shown to be sufficient to squeeze out the contents of an encephaloid tumor situated upon the back.[2]

A ball can gravitate from the occiput to the sacrum. An enormous abscess beneath the skin of the back may be caused by the unsuspected presence of such a missile. The collection will be limited below by the crests of the iliac bones, and by the posterior sacral aponeuroses. Illustrative cases are mentioned by Portal,[3] and were observed by the author during the American civil war.

The muscles of the back are not efficient in maintaining the erect position of the body, but guide and limit its movements.

The cervical muscles, while consisting of differentiations of the muscular layers pertaining to the region of the back, are often the factors in torticollis and in associated conditions with which the lower muscles have little or nothing to do. M. J. Moses,[4] in the course of a careful study of these muscles in relation to the treatment of a case of traumatic torticollis, found that the Sterno-Cleido-Mastoideus muscle was not the primary cause of the deformity, but that it was due to an inflammation occurring in the neck on one side, with resulting contraction of the whole or part of the following muscles: The Trapezius, Splenius Capitis, Rectus Posticus Capitis Major, Rectus Posticus Capitis Minor, Obliquus Superior, and Obliquus Inferior behind; and the Rectus Capitis Anticus Major, Rectus Capitis Anticus Minor, and Rectus Capitis Lateralis in front.

Dr. John Struthers[1] found the muscles normally arising from the spinous process of the axis displaced to the spinous process of the third vertebra. The spine of the axis lacked its usual bifurcation and great size. The inferior oblique retained a small slip of origin from the axis. It was held by this observer that the epispinous bones (represented in the two tubercles which are usually developed from the spinous process of the axis for the attachment of the Rectus Major and the Obliquus Inferior muscle) had by some unknown cause become detached, and had slipped to the spine of the adjoining vertebra below.

The Muscles of the Thorax.

The muscles of this group are the following:—

The Intercostals.
The Triangularis Sterni.

THE INTERCOSTAL MUSCLES.

The Intercostal muscles are two in number for each intercostal space. They constitute a series of eleven muscles situated on either side of the thorax.

The Internal Intercostal muscle occupies the deeper of the two planes of the intercostal space. It fills the anterior portion, namely, from the angle of the rib forward to the sternal extremity. Its fibres are directed obliquely downward and *backward*.

An aponeurotic extension is continued backward from each muscle to the vertebræ.

Under the name of the Subcostal muscles are included a few subpleural fasciculi which are separated from the plane of the intercostal muscles, and which pass over two or three intercostal spaces.

The External Intercostal muscle lies to the outer side of the Internal; its fibres are directed downward and *forward*, and are to be found from the tubercles of the ribs forward to near the ends of the costal cartilages. At this point they are continuous

[1] Memoirs, i. 313.
[2] Holmes's System of Surgery, i. 523.
[3] Anatomie Médicale, ii. 12.
[4] New York Med. Journ., 1873, xvii. 58.

[1] Edinburgh Med. Journ., May, 1863, 1041.

with the fascial extension passing in front of the sternum.

Use.—Concerning the functions of the intercostal muscles observers are by no means agreed. The writer has taught that the External Intercostals raise the ribs, and that the Internal Intercostals depress them. In the spaces between the costal cartilages it appears that both muscles depress the cartilages.[1]

THE TRIANGULARIS STERNI.

The Triangularis Sterni muscle, also known under the names of the Sterno-Costal and Transverse Thoracic, arises from the lateral margin of the lower portion of the gladiolus, from the upper half of the ensiform cartilage, and from the sternal ends of the fifth and sixth costal cartilages. Its fibres diverge to be inserted by fleshy digitations into the costal cartilages and into the sternal ends of the ribs from the fifth or sixth to the second.

This muscle is believed to be an upward extension of the Transversalis Abdominis.

The Diaphragm.

The Diaphragm is a musculo-tendinous septum between the thorax and the abdomen. It is wider from behind forward than from side to side. Above it is in contact with the pleuræ and the pericardium; and below with the peritoneum.

Since the tendinous fibres are central and continuous with the complicated peripheral muscular fibres, it is well to arrange the description under the following heads: (*a*) Muscular fibres arising from the bodies of the vertebræ; (*b*) Muscular fibres arising from the transverse processes of the vertebræ and the associated structures; (*c*) Muscular fibres arising from the side of the thorax; (*d*) The central tendon.

(*a*) The muscular fibres arising from the bodies of the lumbar vertebræ from the first to the fourth are called the *crura*. They ascend to decussate in the posterior central margin of the Diaphragm to inclose the aortic orifice, thence to diverge to define the œsophageal orifice, again to converge to limit this orifice anteriorly at the edge of the central tendon.

(*b*) The fibres from the transverse processes are short and broad, and continuous with the preceding. They pass directly upward into the lateral posterior portions of the tendon. They likewise arise from the *ligamenta arcuata*—a name given to the arches of tendinous fibres passing from the body of the first lumbar vertebra over the Psoas muscle to the end of the transverse process (*ligamentum arcuatum internum*), and from the last-named point to the last rib (*ligamentum arcuatum externum*).

(*c*) The costal portions arise from the inferior margins of the thorax from the last six or seven ribs and the ensiform cartilage, interdigitating with the origin of the Transversalis Abdominis muscle. These fibres are shorter than the vertebral. They are weakest opposite the ensiform cartilage, where indeed the peritoneum and pericardium often lie in contact.

(*d*) The central tendon. This is more or less trilobed, the middle portions answering to the deficiency of the ensiform muscular fibres; of the lateral portions the right is somewhat the longer. It is pierced by an opening, *foramen quadratum*, for the passage of the inferior vena cava and a branch of the phrenic nerve.

The foramina of the Diaphragm, as above indicated, are three in number: the aortic, œsophageal, and the *foramen quadratum*.

The *aortic* is defined at the sides by the tendinous fibres at the median edges of the decussating crura, and behind by the bodies of the vertebræ. In addition to the aorta it transmits the thoracic duct and azygos vein.

The elliptical *œsophageal foramen* is embraced by muscular fibres of the crura. Occasionally its anterior portion is tendinous. It transmits the œsophagus and the pneumogastric nerves.

The *foramen quadratum* is described above under section (*d*).

The great splanchnic and other sympathetic nerves pass through the Diaphragm to the outer side of the crura, or they may sometimes, in part, pierce their structure.

The left convexity of the diaphragm usually extends from one to two ribs below the level of the right. Instead of the left being oval, like the right, it is more of a half-moon shape; the greater portion of it is behind, owing to the position of the ventricles and apex of the heart in front of the left side of the chest.[1]

Use.—The Diaphragm is the chief muscle of respiration. It is to the base of the thorax what the Leva-

[1] For an account of the different views concerning the action of these muscles the reader is referred to Quain's Anat., 8th ed., vol. i. 312; Kuss's Physiologie, Amer. ed. Note, 290; A. W. Volkmann's Zeit. für Anat. und Entwickelungsgesch., ii. 1876, 159; Martin and Hartwell, Journ. of Physiology, ii., 24; W. W. Keen, Trans. College of Physicians of Phila., i. 3d Series, 97. L. Traube, Gesammelte Beiträge zur Pathologie und Physiologie, Berlin, i. 142–183, 1871. A. Ransome, Proc. Roy. Soc., Nov. 22, 1872.

[1] Sibson's Medical Anatomy, Col. 41.

tor Ani and Sphincter Ani muscles are to the inferior trunkal plane, and what the Mylo-Hyoid muscle is to the floor of the mouth. It descends in inspiration, and becomes slightly flattened; it ascends in expiration, and becomes convex. Moderate stimulation of the fibres of the muscle in a living animal will cause only those fibres receiving the stimulus to contract. Pronounced stimulation will throw the entire muscle into contraction. In tranquil breathing the muscle ascends about one inch. The right half reaches a point as high as the fifth rib, *i. e.*, about two inches below the nipple. It may, under favorable conditions, ascend as high as the fourth costal cartilage.

Remarks.—Diaphragmatic hernia: This rare form of hernia is usually seen in the left side, owing probably to the imperfect support here observed as compared with the right. It may occur through a scar caused by a gunshot wound or by any old injury. The opening may be in the middle of the left leaflet, and barely admit the tip of the forefinger, or it may allow a loop of the transverse and descending colon to pass together with a large portion of the omentum. A case is recorded by Chas. W. Chancellor,[1] in which a knuckle of the transverse colon and jejunum had passed through an artificial opening in the middle of the left leaflet. Instances are known in which the pyloric end of the stomach passed into the thorax through a diaphragmatic rupture.

The Diaphragm may be congenitally imperfect. Gilman Davies[2] met with an instance in which the left leaflet was defective, excepting at its posterior portion. The intestines, from their origin to the lower portion of the large intestine, were lodged in the thorax.

Severe violence, as compression of the lower part of the chest between the cars of a railway train, may cause rupture of both the muscular and the tendinous structure of the Diaphragm. Vincent Jackson[3] mentions such a case; the rent beginning near the middle line in the neighborhood of the vertebral column, and extending thence obliquely upward and outward, but not quite reaching the thoracic wall. The rent admitted the stomach, spleen, transverse colon, and part of the small intestine.—The rupture sometimes occurs in the muscular structure only, and extends in the direction of the fibres. In a case described by Kendall[4] the slit was four inches long. Through this opening the stomach, transverse colon, and about two feet of the small intestine had protruded.

Palpitation of the heart, when associated with a state of inanition, is, according to Winslow and Portal,[1] due to the weight of the liver, stomach, and intestines making traction upon the Diaphragm.

Owing to its comparatively loose texture, and to its intimate relation both to abdominal and thoracic organs, the Diaphragm transmits inflammatory changes. Hepatitis and nephritis may thus secondarily induce pleurisy and pneumonia. An abscess between the liver and the thoracic wall may excite empyema. An abscess above the Diaphragm may rupture the muscle and permit the pus to escape into the abdomen, while on the other hand hepatic abscess may perforate the Diaphragm, allowing pus to enter the thorax.

The vault of the Diaphragm can be forced by abdominal tumors to a higher point than that mentioned in the text. It has been found under these circumstances as high as the third or even the second dorsal vertebra, or as high as the second rib on the right side, and the fourth rib on the left.[2]

The descent of the Diaphragm in respiration is greater than the descent of the liver, thus showing on theoretical grounds that the liver may be compressed.

The Diaphragm has been known to be perforated by fragments of a fractured rib.[3] It is difficult to surmise how a wound penetrating the chest walls at the lower ribs during expiration can fail to penetrate also the diaphragmatic fibres.—In advanced post-mortem digestion of the stomach the Diaphragm is often involved.[4]

Muscles of the Abdomen.

The muscles in the region of the abdomen are—

The External Oblique.
The Internal Oblique.
The Transversalis.
The Rectus.
The Pyramidalis.
The Quadratus Lumborum.

THE EXTERNAL OBLIQUE.

The External Oblique muscle, the most external of its group, is a broad sheet of muscular tissue ex-

[1] Amer. Journ. Med. Sci., Oct. 1855, 405.
[2] Amer. Journ. Med. Sci., Jan. 1846, 127.
[3] Med. Times and Gazette, March, 1858, 318.
[4] Med. Times and Gazette, 1865, 253.

[1] Anatomie Médicale, tom. v. 94.
[2] Bonnet, Traité complet des Maladies du Foie, 1841, 187.
[3] Carle Morgan, Trans. Path. Soc. London, 1873, 173.
[4] P. H. Bernard, quoted in Richet, Anat. Chirurg., 564

tending from the thorax to the innominate bone, and constituting in part the side and the front of the abdominal wall. It arises from the anterior outer surfaces of the ribs from the fourth to the twelfth. Above, it interdigitates with the origin of the Serratus Magnus, from the fourth to the eighth rib, and below with the Latissimus Dorsi.

The posterior fibres pass vertically downward from the last ribs, and are inserted fleshy into the outer lip of the crest of the ilium. The remaining fibres pass obliquely downward and inward, and are inserted into the linea alba and Poupart's ligament.

Poupart's ligament is a tendinous extension lying between the anterior superior spinous process of the ilium and the pubis. It is continuous above with the aponeurosis of the External Oblique muscle, and below with the fascia of the thigh. At its insertion it aids in forming the external abdominal ring.

The *external abdominal ring* is an oblique narrow triangular opening situated one inch to the outer side of the pubis, and designed for the escape of the spermatic cord. It is bounded externally by Poupart's ligament, and internally by the aponeurotic fibres of the External Oblique muscle. The outer border is called the *outer column* or *pillar*, and the inner the *inner column* or *pillar*. A small number of sparsely distributed curved fibres stretching from one to the other have received the name of the *intercolumnar fibres;* these, becoming strengthened below, have been called the *intercolumnar fascia.*

Relations.—Below is the Internal Oblique muscle, a small fasciculus of which lies beyond the posterior vertical fibres.

THE INTERNAL OBLIQUE.

The Internal Oblique muscle (Plate L. fig. 2) is situated beneath the External Oblique. It is a broad sheet of muscular fibre extending upward and forward, and thicker in the middle than at the sides. It arises from the lumbar aponeurosis, from the crest of the ilium and its anterior superior spinous process, and from the outer half of Poupart's ligament.

The fibres from the lumbar aponeurosis and the beginning of the iliac crest pass nearly vertically upward, and are inserted into the twelfth rib. Those arising from the remaining portion of the iliac crest pass obliquely forward and upward, and are inserted into the lower margin of the cartilages of the ninth to the eleventh ribs and into the ensiform cartilage and the linea semilunaris of the abdominal wall; while those arising from Poupart's ligament pass forward in a radiating manner into the *linea semilunaris*, and into the tendinous structures continuous with it at the symphysis pubis.

The aponeurosis of the muscle is broader above than below, and extends from the inferior margin of the thorax to the Rectus Abdominis at the outer border of which it divides, the one portion going in front to be lost in the aponeurosis of the External Oblique, the other passing behind to be continuous with the aponeurosis of the Transversalis muscle. The anterior portion is weaker than the posterior, and is abruptly terminated about midway between the umbilicus and the pubis to form the *semilunar fold of Douglas.*

But while the Rectus at this part of the abdomen is thus weakened, it is strengthened in front by the undivided aponeurosis of the Transversalis, and at the side by the union of the aponeuroses of the Internal Oblique and Transversalis muscles. This union constitutes the so-called "conjoined tendon," which is inserted into the symphysis pubis.

The Cremaster muscle is a special arrangement of the fibres of the Internal Oblique muscle which descends in front of the spermatic cord. It is attached at the inner end to Poupart's ligament and to the spine and crest of the pubis. Between these points the loop-like fibres dip down and are incorporated with the *cremasteric fascia.*

A transverse line (*linea transversa*) often extends from the tenth rib; less frequently a similar one corresponds in position to the eleventh.

THE TRANSVERSALIS.

The Transversalis muscle (Plate L. fig. 3) arises from the deep or anterior layer of the vertebral aponeurosis, from the lower borders of the six lower ribs, and from the inner lip of the iliac crest at its anterior two-thirds. Its fibres are of unequal length, the middle being the longest. It unites with the Internal Oblique at the origin of the latter from Poupart's ligament, and at the conjoined tendon, as already noticed. It is inserted by a thin aponeurosis into the posterior layer of the sheath of the Rectus muscle, except at the lower portion where it joins the Internal Oblique in passing in front. The aponeurosis is narrower than the other abdominal muscles.

THE RECTUS ABDOMINIS.

The Rectus Abdominis muscle arises from the upper border and anterior surface of the pubis. It passes upward as a broad ribbon-shaped muscle, and is inserted into the outer sides of the cartilages of the fifth, sixth, and seventh ribs, and the ensiform

cartilage. It is remarkable for the tendinous transverse lines interrupting the vertical bundles composing it. These lines have received the name of the *lineæ transversæ* (*inscriptiones tendineæ*), and are disposed as follows: one opposite the navel, one halfway between it and the ensiform cartilage, and one opposite that cartilage. A fourth, though incomplete, often divides the tract between the navel and the pubis.

Relations.—The rectus muscle is in part inclosed in a sheath, already described (see External and Internal Abdominal Muscles).

The Linea Alba.—This is a white fibrous band formed by the intimate union of the aponeuroses of the Oblique and Transversalis muscles. It occupies the interval between the Recti muscles, and embraces the umbilicus. It is slightly broader above than below, where a larger number of longitudinal fibres are seen.

The *linea alba* is a favorite locality for incision in ovariotomy, and in the high operation for stone in the bladder.

The Linea Semilunaris.—This resembles the linea alba in construction, but is curved and lies to the outer side of the Rectus muscle. Each line is about three inches from the umbilicus.

Remarks.—The Rectus may be ruptured by muscular exertion. A good example of this is presented by C. Holthouse.[1]

A man while tying up a scaffold pole, both his hands being raised for that purpose, suddenly stepped from the plank upon which he was standing, and saved himself from falling by hanging on with his hands, his body being suspended in the air. At the same instant he felt a sudden tear in the region of the Rectus muscle.

In a case reported by S. B. Richardson,[2] the rupture involved all the fibres of the muscle of the right side at a point two inches below the umbilicus. The corresponding deep epigastric vessels and nerves were also completely severed. A hæmatoma ensued, accompanied by symptoms of peritoneal irritation, which were supposed to indicate ventral hernia. An exploratory incision was made and the clot turned out. The patient, a male of twenty-eight years, recovered.

The muscle may be ruptured in tetanus.[3] In a case reported by Curling[4] the muscle of the right side, about one inch above the pubis, was found after death to be torn transversely. Sédillot,[1] in collecting the cases of ruptured muscle, found that thirteen in twenty-one occurred at the termination of the muscular fibres in the tendon, while eight occurred in the fleshy fibres alone.

Rupture of the Rectus with hemorrhage is not infrequent in typhus and typhoid fever. Zenker[2] shows that such lesions are due to disintegration of the muscular fibres. He describes two forms, one in which the sheathed structure of the muscle disappears, and in which the sarcous matter is converted into a quantity of minute granules; and the other in which the sarcolemma becomes filled with masses of a transparent strongly refracting waxy substance. Murchison describes[3] an abscess occurring in the Rectus muscle of a man, thirty-seven years of age, who died of typhoid fever.

The sheath of the Rectus may be the seat of an enormous abscess, which, according to Mr. Adams,[4] may have its origin in the symphysis pubis.

Contraction of the bellies of the Recti muscles, owing either to inflammation of the subjacent peritoneum or stomach, or in cases of increased muscular irritability, to the mere application of the hands, is frequently mistaken by inexperienced observers for hepatic enlargement.

The spaces between the Abdominal muscles and between the Rectus and its sheath may serve for the location of abscesses and for fistulous tracts. In neglected abscess about the hip-joint, pus has been known to point far up the abdominal wall, having found its way thither between the Oblique muscles. If a collection either of air, pus, or blood lies in the space between the External Oblique muscle and the skin, it can be distinguished from one more deeply situated, by the fact that it is arrested at Poupart's ligament.

THE PYRAMIDALIS.

This muscle is of a triangular shape as the name implies, and rests within the sheath of the Rectus. It arises from the horizontal ramus of the pubis close to the symphysis. It ascends along the inner border of the Rectus, and is lost within the linea alba.

[1] Trans. Path. Soc. London, xiii. 1862, 263.
[2] American Journ. Med. Sci., Jan. 1857, 41.
[3] Francis Mason, Trans. Path. Soc. London, 1868, 448.
[4] Ibid., 1865, 235.

[1] Mém. et Prix de la Soc. de Méd. de Paris, 1817.
[2] Ueber die Veränderungen der wilkurlichen Muskeln im Typhus Abdominalis, Leipzig, 1864.
[3] Trans. Path. Soc. London, xvi. 275.
[4] Trans. Path. Soc. London, v. 1854, 245.

THE QUADRATUS LUMBORUM.

The Quadratus Lumborum lies on the posterior wall of the abdomen, and occupies the interval between the transverse processes of the lumbar vertebræ, the last rib, and the innominate bone.

It arises from the posterior portion of the iliac crest and the ilio-lumbar ligament, and is inserted by tendinous slips into the transverse processes of the four upper lumbar vertebræ, and by a broad tendon into the inferior border of the twelfth rib.

Aeeessory tendinous slips arise from the inferior transverse processes, and join the muscle near its insertion into the rib.

Use.—The anterior portion of the Quadratus muscle is considered by Meyer to be functionally distinct from the posterior. The former he identifies as a Scalenus Lumborum, and as a depressor of the last rib, while he holds the latter to be an Ileo-Lumbalis and a tractor of the lumbar vertebræ.

The muscle strengthens the posterior wall of the abdomen.

Remarks.—The muscle is incised in colotomy and in nephrotomy. It is the frequent seat of pseudo-neuralgic pains grouped under the name of lumbago. The region of the loin, which in a general way is embraced within the limits of the two Quadrati and the dorsal surface of the lumbar portion of the spine, is the site to which the pains of the kidney are referred.

IV. THE MUSCLES AND FASCIÆ OF THE UPPER EXTREMITY.

(1) The Muscles.

The muscles of the upper extremity embrace an extrinsic and an intrinsic set.

The Extrinsic muscles include the following:—

- The Trapezius.
- The Latissimus Dorsi.
- The Rhomboideus.
- The Levator Anguli Scapulæ.
- The Pectoralis Major.
- The Subclavius.
- The Pectoralis Minor.
- The Serratus Magnus.
- The Deltoid.[1]

[1] The Deltoid is, in a strict sense, an intrinsic muscle. It has been included in the extrinsic set for the reason that its relations are with the Trapezius, with which it is fused in the majority of animals.

All the remaining muscles of the upper extremity belong to the intrinsic set.

THE TRAPEZIUS.

The Trapezius presents a triangular figure, the base of which rests along the line of the vertebral spines, the apex being directed toward the shoulder. The upper or occipital border is rounded, while the lower or dorsal is pointed.—The muscle arises by a thin aponeurosis from the occipital bone at the protuberance, and at the median third of the superior semicircular line; from the ligamentum nuchæ, the lower cervical and all the dorsal spines, as well as from the supraspinous ligaments between them.—The upper fibres pass downward, outward, and forward to be inserted into the upper border of the spine of the scapula its entire length, and also into the acromion and the acromial end of the clavicle.—The lower fibres, from the third to the twelfth dorsal spines, pass upward to glide over the triangular area at the base of the spine, and to be inserted by a narrow tendon into the median or axillary half of this portion of the scapula.

Use.—The Trapezius, when acting as a whole, fixes and serves to maintain the position of the scapula against the trunk, an action in which it is assisted by the Serratus Magnus.—The upper fibres can raise the scapula and the clavicle.—The middle fibres tend also to raise the scapula by increasing the obliquity of its spine, and by elevating the glenoid angle. They are of special use in fixing the scapula in this position preparatory to the action of the Deltoid and the Supra-Spinatus muscles.—The ascending fibres draw the scapula downward and backward to the position of rest, thus antagonizing the remaining fibres. The ascending fibres may aid the Latissimus Dorsi.

When the insertion of the Trapezius is fixed, the upper fibres draw the head backward and outward toward the shoulder.—When both sides act conjointly, the head is pulled directly back.—When the body is suspended by the raised upper extremity, the lower fibres can twist the vertebral column toward the shoulder.

The description of the Trapezius embraees the following details:—

The muscle arises entirely by tendinous points, which at the oeeiput are elosely adherent to the skin, and are of a dull ligamentous hue.—From the sixth eervical to the third dorsal spine the fibres of origin are glistening and conspicuous. They increase in length toward the base of the neck, and abruptly diminish at the upper dorsal spines, and

form with the fibres of the muscle of the opposite side an elliptical aponeurotic space. The fibres from the remaining four spines are short, but again become conspicuous toward the last three dorsal spines, where, in conjunction with the corresponding slips of the opposite side, a small triangular space is seen, whose base is directed upward. The fibres of insertion of the upper set are musculo-tendinous, and short toward the clavicle and acromion, while those received along the spines are distinctly tendinous.—The fibres of insertion of the lower set end in a small triangular aponeurosis, which is received upon the triangular eminence at the root of the spine of the scapula. A small bursa was found by Luschka and Synnestedt beneath this tendon.

The Variations of the Trapezius embrace: (1) Errors of cleavage, by which the occipital, cervical, and dorsal portions may be distinct from one another, or by which a deeper lamina may pass from some of the transverse cervical processes to the humerus (Occipito-Humeral muscle), or to the clavicle (Occipito-Clavicular muscle), or by which a deep fascicle may pass from the occiput to the scapula (Occipito-Scapular muscle). These variations are reversions to the forms of the muscle seen in quadrupeds. (2) Errors of fusion, by which either the occipital or the clavicular fibres unite with adjacent portions of the Sterno-Cleido-Mastoideus muscle. (3) Errors of defect, seen in both origin and insertion. Thus the occipital portions may be absent, and fewer vertebræ be included in the origin than is normal.—In the same manner the clavicular portions may be absent.

THE LATISSIMUS DORSI.

This, the broadest muscle in the body, is of a rectangular shape. It arises from the lower four or six dorsal vertebræ (where it is covered by the lower portion of the Trapezius), from the aponeurosis connected with the spinous processes of the remaining dorsal vertebræ, from the spinous processes of the sacrum, and from the posterior portion of the outer lip of the innominate bone. A few muscular fibres of origin arise from the pelvis to the outer side of the aponeurosis, and yet others from the last three or four ribs. The muscle is directed upward and outward, and crosses the angle of the scapula. Its fibres here converge and wind around the Teres Major to form a flat quadrilateral tendon about two inches in length, which is inserted in the posterior lip of the bicipital groove of the humerus.

Use.—This varies according to the position of the arm. When the arm is elevated, the muscle aids in depressing and drawing it backward; when the arm hangs at the side, it pulls the arm backward and toward the buttock. Hence the Latin names given it of the *Tersor Ani* and the *Scalptor Ani*. When the Trapezius and the Rhomboideus are atrophied, the Latissimus Dorsi draws the scapula toward the spine.

Nerve.—The muscle is supplied by the subscapular nerve and the intercostal nerves.

The fibres of origin are composed of two sets: one, the thin, small slips covered by the Trapezius muscle; and the other, more extensive, arising from the lumbar aponeurosis. —The upper fibres of the muscle are horizontal, the lower oblique; those arising from the pelvis and the ribs are vertical.—As the muscle passes over the inferior angle of the scapula it receives quite constantly a special fasciculus from it. —Beyond the inferior angle the muscle is slightly twisted, so that the inferior border is at first anterior and then superior, while the superior, or horizontal, is afterward inferior.— The tendon is at first adherent to the tendon of the Teres Major, but becomes free prior to insertion.—The tendon may be inserted at the bottom of the bicipital groove, or at the base of its inner lip. It extends a little higher than the tendon of the Teres Major, and occasionally sends a fibrous slip as far as the lesser tuberosity.

The Variations of the Latissimus Dorsi are of two kinds. (1) Variation in origin: The origin from the dorsal spines may include the fourth dorsal; accessions may come from the eighth dorsal, and from the ninth rib.—The iliac origin may be absent. (2) Variation in insertion: Slips may pass to the capsule of the shoulder-joint, to the coracoid process, to the fascia of the arm, and to the Pectoralis Major, Teres Major, and Serratus Magnus muscles. Some of these slips may be separated from the main muscle by inscriptions. The last-named variations are suggestive of the arrangement in quadrupeds, in some of which the Latissimus constantly effects important fusions with the Pectoralis Major, and sends slips down the anterior extremity, often as far as the elbow, or in some forms even to the wrist.

Relations.—In front of the tendon, just prior to the insertion, lie by direct relation the musculo-spiral nerve and its muscular branch to the Triceps. Still further in front, by indirect relation, lie the axillary vein and artery, the musculo-cutaneous, ulnar, and median nerves. The muscle forms the posterior wall of the axilla.

THE RHOMBOIDEUS.

The Rhomboideus muscle consists of two slips: the Rhomboideus Major and the Rhomboideus Minor. The Rhomboideus Major arises partly by short tendinous slips, and partly by a short aponeurosis from the dorsal spines of the four upper dorsal vertebræ and the corresponding supra-spinous ligaments. It passes downward and outward without suffering diminution, and is inserted into the inner margin of the vertebral border of the scapula.—The Rhomboideus Minor lies proximally to the Rhomboideus Major. It arises from the ligamentum nuchæ in the region of the lower cervical vertebræ, and from the first dorsal spine. It is inserted on the triangular space at the beginning of the spine of the scapula.

Use.—To draw the shoulder toward the middle line of the back, and to antagonize the tendon of the Trapezius in rotating the scapula. Acting with the Teres Major it can depress the elevated humerus (Duchenne).

Nerve.—The muscle is supplied by a continuation of the nerve for the Levator Anguli Scapulæ.

The Variations of the Rhomboideus include: (1) A disposition to planar cleavage. (2) Slips of contribution to the Teres Major, Latissimus Dorsi, and Serratus Magnus muscles. (3) Arrests of development, by which the origin may be confined to a smaller number of spines than five, and the insertion to a portion only of the vertebral margin of the scapula.

The genealogy of the muscle includes slips passing upward to reach the atlas or even the occiput.

THE LEVATOR ANGULI SCAPULÆ.

This muscle arises from the posterior tubercles of the transverse processes of the upper four or five cervical vertebræ. The slips soon unite to form a flat narrow muscle which is inserted on the vertebral border of the scapula between the level of the spine and the superior border.

Use.—To raise the superior angle of the scapula, and when the scapula is fixed to move the neck laterally.

Nerve.—This is derived from a branch of the deep set of the cervical plexus.

Variations.—It may unite with the Serratus Magnus, and derive slips from the Trapezius. Its origin may reach as high as the transverse process of the atlas, or as low as the seventh cervical vertebra. Its insertion may not be limited to the angle of the scapula, but may include a portion of the upper border of the bone. It may send slips to the first and second ribs, to the Serratus Posticus Superior, to the Scalenus Medius, to the Splenius Capitis, and to the Complexus muscles. It may undergo longitudinal cleavage, and be composed of three to six slips.

THE PECTORALIS MAJOR.

The Pectoralis Major muscle arises from the median two-thirds of the clavicle, from the greater portion of the front of the sternum, from the first six costal cartilages, and from the aponeurosis of the External Oblique muscle of the abdomen. The fibres converge to be inserted into the outer margin of the bicipital groove of the humerus.

This muscle is a broad fleshy mass placed at the upper and anterior portion of the chest wall, and forms the anterior border of the axilla. Just prior to the formation of the tendon it is of a quadrate shape, and is rather coarsely fasciculated. The lower border of the muscle answers to the position of the fifth rib as it lies on the side of the thorax.

Use.—To adduct the humerus. The shoulder, when its muscles are fixed, can be raised by the clavicular fibres; these also act with the anterior fibres of the Deltoid and the Coraco-Brachialis in swinging the humerus forward. The sternal fibres draw the shoulder downward and inward, and depress the arm from the elevated position. In this act they are assisted by the Latissimus Dorsi and the Teres Major muscles.

Nerves.—These are derived from the anterior thoracic branches of the brachial plexus.

The Pectoralis Major consists of a clavicular and a sterno-costal portion separated by a horizontal interspace. This in emaciated subjects is sufficiently pronounced to be detected beneath the skin, and is marked when the arm is abducted.

The *clavicular portion* arises by short, tendinous fibres from the anterior border of the sternal half or two-thirds of the clavicle, and at times from the sterno-clavicular capsule and the outer border of the manubrium.

The *sterno-costal portion* arises by two imperfectly defined layers as follows: the superficial layer from the anterior surface of the sternum, and inferiorly by a slip from the anterior portion of the sheath of the Rectus Abdominis muscle; the deep layer by several irregular and inconstant digitations from the second to the sixth costal cartilage, and from the osseous part of the sixth rib.

The fibres from this extensive origin pass outward toward the humerus: the upper fibres, the most robust of all, tending downward, the middle fibres outward, and the lower fibres upward. They finally converge to constitute the inner wall of the axilla, at which point the clavicular fibres are found at the lower anterior portion, and the costo-clavicular fibres at the upper portion of the muscle. Thus, in part twisted upon themselves, the fibres form a pocket which is open above and occupied by fat and connective tissue, and occasionally by a bursa. The outer and inner walls of the pocket are formed by the clavicular and costal portions of the muscle, while the base is formed by their union.—The clavicular portion is inserted in the outer bicipital ridge of the humerus near the deltoid insertion. The costal portion here passes upward nearly parallel to the foregoing, and is inserted into the upper part of the ridge. Both portions are intimately held to the fascia of the arm.

The Variations of the Pectoralis Major arrange themselves into four divisions: (1) A disposition in common with other extrinsic muscles to send slips to the superior extremity beyond the bicipital ridge, or to the muscles about the shoulder-joint. Among these may be mentioned slips to the fascia of the arm, to the Latissimus Dorsi, to the Supra-Spinatus, to the Deltoid, and to the Biceps muscles. (2) A tendency to unite in part with the Deltoid and the Pectoralis Minor muscles, and to effect an extension of fibres to the Rectus Abdominis, and to the External Oblique.

(3) Excesses of development, by which the muscle may be doubled, by which fibres may pass across the median line to the muscle of the opposite side, and by which additional slips of origin may be secured from the seventh and eighth costal cartilages. (4) Defects of development, by which one or more of its three divisions may be absent.

Remarks.—The interval usually present between the Pectoralis Major and the Deltoid muscle serves as a guide to the position of the coracoid process of the scapula and the axillary artery. The rather loose connective tissue between the muscle and the Pectoralis Minor is sometimes the seat of abscesses. These do not tend to involve the axilla, since a tolerably firm layer of fascia extending from the clavicle and the coracoid process confines the pus to its sub pectoral bed. Very rarely enormous collections of pus form at the side of the chest, dissecting beneath the Pectoral, Serratus Magnus, and Latissimus Dorsi muscles.—Collections between the skin and the muscle do not involve the Deltoid by reason of a similar septum of fascia passing through the pectoro-deltoid interval from above downward to join the costo-coracoid membrane.

THE SUBCLAVIUS.

This little muscle is concealed by the coraco-clavicular fascia, and lies between the approximate surfaces of the clavicle and first rib. It arises from the upper surface of the first intercostal cartilage at its junction with the rib, and is inserted on the under surface of the clavicle at its outer part.

Use.—The Subclavius muscle fixes the clavicle to the thorax, and aids in preventing dislocation of the sterno-clavicular joint. It will be observed that the muscle will, in contracting, force the sternal end of the clavicle deep in its articulation. According to Sappey, when the clavicle is broken at its middle, the muscle acting with the adductors of the arm will pull in the outer fragment, which is thus placed below and a little in front of the inner fragment.

Among the Variations may be mentioned the following:—

The muscle may be duplicated, *i. e.*, it may have two separate slips upon the first rib. A separate fasciculus may extend from the front of the sternum to the corresponding surface of the clavicle.[1]

At its origin the muscle presents a cylindroid compressed tendon. It soon assumes a bi-penniform appearance, the tendon appearing for the most part on the under surface of the muscle. At the middle of the mass the tendon is concealed. The fleshy fibres on the upper portion of the muscle are of different degrees of obliquity; those farthest from the insertion being but little inclined, while others are nearly parallel to the axis of the clavicle.

According to Henle, the costo-clavicular ligament passes for the most part behind the muscle.

The Supra-Clavicular Muscle.—Under this head Luschka describes a small slip, fleshy throughout, arising from the upper margin of the sternum, and inserted into the external end of the clavicle.

THE PECTORALIS MINOR.

The Pectoralis Minor muscle is placed at the side of the chest beneath the Pectoralis Major, which conceals it. It arises from the upper borders of the costal cartilages, from the third to the fifth, passes upward and outward, and is inserted into the coracoid process of the scapula.

Use.—To draw the scapula toward the thorax.

Nerves.—The Pectoralis Major and Minor muscles are supplied by the anterior thoracic nerves.

Above the muscle lies the Pectoralis Major, from which it is separated by a quantity of loose connective tissue. To the outer side, below, is the Serratus Magnus.

The Pectoralis Minor is a thin, delicate muscle, covered by a glistening fascia, which is continuous above with the costo-clavicular fascia, and below with an aponeurosis over the external intercostals. It is inserted upon the anterior half of the inner border and the upper surface of the coracoid process near its summit, and sends a thin layer outward to the tendon of origin of the Coraco-Brachialis. A bursa is often found beneath the tendon which has often been seen to communicate with the shoulder-joint. Günther mentions a case in which an abscess was found limited to the surface of the coracoid process corresponding to the insertion of the Pectoralis Minor.

Variations.—The lower border of the Pectoralis Minor rarely appears below the lower border of the Pectoralis Major.—The muscle may arise from the second to the fourth, or from the fourth to the sixth ribs, or may extend its line of insertion to the capsule of the shoulder-joint or to the humerus. Infrequently the muscle is inserted entirely upon the capsule.—A muscle, superficial to the Pectoralis Minor, may arise from the sternal ends of the first and the second ribs, and pass to the capsule of the shoulder-joint.[1]

THE SERRATUS MAGNUS.

The Serratus Magnus is a flat, nearly square muscle, placed at the side of the thorax, presenting a digitate oblique lower border, and extending from the ribs to the scapula. It arises by fleshy slips from the first to the eighth or ninth rib inclusive; passes backward and upward, following the general curve of the side of the thorax; and is inserted along the

[1] W. Gruber, Mém. de l'Acad. St. Petersbourg, 1860, 3, fig.

[1] W. Gruber, Mém. de l'Acad. St. Petersbourg, 1860, 3, fig.

vertebral border of the scapula between the insertion of the Rhomboideus muscle and the origin of the Subscapularis.

When the arm is raised from the vertical to the horizontal position, four obliquely placed muscular elevations are seen on the parietes of the trunk. They answer to the digitations of the Serratus from the sixth to the ninth.

Use.—The Serratus Magnus intervenes as a soft muscular cushion between the scapula and the sides of the chest. A bursa, which sometimes exists between it and the scapula, lessens friction. When the entire muscle contracts, the ribs being fixed, the scapula is drawn forward (adducted) and held firmly against the thorax, thus enabling the muscles arising from the scapula to secure definite lines of traction. The position described precedes the action of the Deltoid, the Coraco-Brachialis, the Pectoralis Major, the Pectoralis Minor, the Triceps, the Supra-Spinatus, the Infra-Spinatus, the Teres Major, and the Teres Minor muscles. The most important of these is the Deltoid, which cannot effectually raise the arm from the vertical to the horizontal position unless the scapula has been previously fixed by the Serratus Magnus.—When the entire muscle contracts, the scapula being retracted by the Levator Anguli Scapulæ, the Serratus, together with the Trapezius and Rhomboidei, assists in raising the ribs.—The Trapezius and Rhomboidei muscles may be considered as antagonistic in action to the Serratus in most of the motions of the scapula. The interval between the Serratus Magnus and the Rhomboideus, at the vertebral scapular border, may be, it is true, compared to an intermuscular septum, as seen in one of the semilunar lines of the abdomen; and Barwell[1] conceives that when the Serratus and the Rhomboidei act together, traction can be made, as though their fibres were component parts of a single muscle, from the fixed ribs directly to the yielding spinal column, and that this movement may, under favorable conditions, produce one of the varieties of lateral spinal curvature.—Paralysis of the Serratus will cause the scapula to be drawn upward by the action of the muscles named above, and the vertebral border to be notably projected from the sides of the body.—When the upper fasciculus acts independently of the rest of the muscle, it, together with the Pectoralis Minor, pulls forward and downward the glenoid scapular angle.[2]

[1] Lateral Curvature of the Spine, 1870, 30.

[2] For a careful study of the uses of the Serratus Magnus, see Busch, Langenbeck's Archiv für Klinische Chirurgie, 1863, 43; also Duchenne, Physiologie des Mouvements.

Nerve.—The Serratus Magnus is supplied by the posterior thoracic nerve.

The muscle may be divided into three portions, as follows: The first (upper) arises by a single slip from the lower border of the first rib, from the external face of the second, and from a fibrous band extending across the first interosseous space. It is inserted into the smooth triangular facet at the upper vertebral border of the scapula near the angle. This fasciculus is separated from the rest of the muscle by a narrow cellular interval. Instances have been recorded in which this slip was absent.—The second, or middle division, arises below the first, from the second, third, and fourth ribs, where the Pectoralis Minor is thin, and sometimes in part also from the aponeurosis of the External Intercostal muscle. Its fibres pass outward, spreading as they do so, to assume a fan-like form, and are inserted into the vertebral border for nearly its entire extent. This division may be absent, while the upper and lower are intact.—The third, or lower division, arises from the remaining ribs, viz., the fifth, sixth, seventh, eighth, ninth, and sometimes the tenth. The muscles of this division are arranged in a convex manner upon the ribs (the sixth slip being the most pronounced), and interdigitate with the upper fibres of origin of the External Oblique muscle. The fibres from this extensive origin converge, as they pass upward and backward, to form a thick rounded mass, which becomes somewhat twisted on itself as it is inserted into the inferior angle of the scapula. There is no cellular interval between the middle and the lower divisions.

Variations. — The Serratus Magnus frequently possesses nine digitations, which arise from but eight ribs, two slips arising from the second. The number of ribs covered by the muscle may vary from eight to ten. Luschka describes the lower division as overlaid in old subjects with a thin layer of firm aponeurotic tissue.

THE DELTOID.

The Deltoid muscle resembles the Greek letter Δ inverted, the upper border being irregularly concave. It arises from the outer concave portion of the clavicle (anterior or median fibres), from the anterior portion of the acromion (middle fibres), from the greater portion of the under lip of the spine of the scapula, and from the infra-spinous fascia near the axillary border (posterior or lateral fibres). The anterior and posterior fibres pass downward obliquely, the middle vertically, and are inserted at corresponding parts of the deltoid ridge of the humerus.

The median fascicles are closely united with the acromio-clavicular ligament, while they are separated from the greater tuberosity by means of a large bursa.

Use.—The muscle, contracting as a whole, and acting upon its insertion, raises the arm to the horizontal position.

The anterior fibres, when they act alone, raise and

adduct the humerus, and assist when both sets act together in the act of folding the arms. When the arm is raised above the horizontal position, these fibres depress and adduct it. They often act in conjunction with the Coraco-Brachialis. When the anterior fibres are active, the posterior fibres are at rest.—The posterior fibres raise the humerus and abduct it. When the arm is raised above the horizontal position, these fibres depress and draw it backward, a movement aided by the Teres Major and Rhomboideus muscles. The anterior fibres are meanwhile relaxed. —The middle fibres are feebler than either of the preceding. They elevate the humerus in a direct line. They can act either with the anterior or posterior fibres in their respective functions.—The actions of the Deltoid muscle, as above described, are dependent upon apposition of the humeral and scapular articular surfaces through the agency of the Supra-Spinatus muscle. — The Serratus Magnus, the long head of the Triceps, and the middle fibres of the Trapezius fix or limit the motions of the scapula during the action of the Deltoid.

Action upon the line of origin is limited to the posterior fibres, which can aid the lower fibres of the Trapezius in drawing the scapula downward.

Outward rotation of the humerus aids the different movements of the Deltoid.

Nerve and Artery.—The Deltoid is supplied by the circumflex nerve and artery.

The Deltoid muscle is remarkably fasciculated. The fascicles are coarse, and are arranged in the form of narrow wedges, seven in number.—The muscle is of loose texture in the clavicular and middle fasciculi, but is aponeurotic over the posterior portion, where it is continuous with the fascia of the Infra-Spinatus. The fascia is stouter as it passes to the Triceps than as it passes to the Biceps muscle. Posteriorly it lies over the head and shaft of the humerus, a large bursa intervening.—The muscle is liable to undergo atrophy — a change that may follow comparatively trivial injuries. When the muscular wasting is marked, the humerus falls away from the scapula. — Sédillot[1] reports an example of rupture of the Deltoid.—The Deltoid, when relaxed, owing to the entire absence of connection with the humerus above the deltoid ridge, can be so grasped as to raise the body of the muscle well from the humerus.

Variations.—The variations of the Deltoid are arranged in six groups. (1) Those examples showing a tendency to cleavage, by which the scapular portion is distinct from the rest of the muscle. The acromial fibres may pass almost independently to the humerus. (2) Those tending to fusion, by which the clavicular fibres pass to the internal intermuscular septum, and are thence continuous with the Brachialis Anticus. The clavicular fibres may also fuse with the Pectoralis Major, the fibres of insertion of the entire muscle becoming continuous with the Supinator Longus. (3) Those in which accessions may be received from the fascia over the Infra-Spinatus muscle. (4) Those in which contributions may be received from the Trapezius. (5) Those in which the acromial or clavicular portions may be absent.

Relations.—The fibres arising from the spine of the scapula overlap the fibres of the external and the long heads of the Triceps at their upper parts. The inferior median portion is supplied by terminal twigs of the artery lying between the Deltoid and the Pectoralis Major. The proximo-median portion, namely, that part lying over the coracoid process, receives a lateral branch from the same artery.

[1] Mém. et Prix de la Soc. de Méd. de Paris, 1817.

The Muscles of the Shoulder.

The muscles of the shoulder, besides those included in the extrinsic set, embrace—

The Supra-Spinatus.
The Infra-Spinatus.
The Teres Minor.
The Teres Major.
The Subscapularis.

THE SUPRA-SPINATUS.

The Supra-Spinatus muscle arises from two-thirds of the supra-spinous fossa, from the upper surface of the scapular spine for its entire length, and from the under surface of the supra-spinous aponeurosis. The muscle is directed outward, the tendon passing over the base of the coracoid process, and is inserted tendinously into the uppermost facet of the greater tuberosity of the humerus, and by a few fibres into the capsule of the shoulder-joint. The tendon has the dull aspect of ligamentous tissue.

Use.—The Supra-Spinatus muscle can elevate the humerus and carry it forward and inward It aids in holding the head of the humerus close to the scapula during the action of the other muscles, notably the Deltoid, and rotates the humerus outward. When the Deltoid acts before the Supra-Spinatus, as when the parts are suddenly brought into action, it is apt to dislocate the head of the humerus. The muscle aids supination, and acts with the Teres Minor.

Hamilton[1] mentions an instance of a woman who, after carrying a bundle of hay upon her head for a long way with her arms uplifted, suddenly threw it to the ground, and in so doing dislocated the head of the humerus. In this case it is fair to suppose that the muscles holding the arm up had become fatigued, and were no longer efficient in retaining the head of

[1] Fractures and Dislocations, 534.

the humerus in close contact with the scapula, while the depressor fibres of the Deltoid muscle in lowering the arm were sufficiently strong to throw the head of the humerus out of the glenoid cavity.

Duchenne[1] believes that the Supra-Spinatus muscle, aided by the Serratus Magnus and the superior portion of the Trapezius, can elevate the humerus without the assistance of the Deltoid. In this act the humerus is carried forward and a little outward. This writer states that, in patients suffering from atrophy of the Supra-Spinatus muscle, the Infra-Spinatus and Trapezius muscles, the Teres Major and the long head of the Triceps can dislocate the head of the humerus with ease.

Nerve.—This is derived from the suprascapular.

No important Variations of the muscle are known.

THE INFRA-SPINATUS.

The Infra-Spinatus muscle arises from the infra-spinous fossa of the scapula, from the under surface of the spine, and by a few fibres from the infra-spinous aponeurosis. The tendon passes over the capsule of the shoulder-joint, from which it is occasionally separated by a bursa (bursa of Hagen), and is inserted into the middle facet of the greater tuberosity of the humerus.

Use.—To roll the arm outward, and to draw it down after it has been elevated.

Nerve.—This is derived from the suprascapular.

The muscle derives some support from the fascia passing between its lower border and the Teres Major, and from the long head of the Triceps muscle.

Variations.—The muscle may split into two or three laminæ, of which the middle, when present, has received the name of the Middle Infra-Spinatus muscle.—The Infra-Spinatus may fuse with the Teres Minor, and may send accessions to the Deltoid, or receive slips from that muscle.

THE TERES MINOR.

The Teres Minor is intimately associated with the Infra-Spinatus. It arises from a groove on the dorsum of the scapula at its axillary border, and from the inter-muscular septum between it and the Teres Major muscle, as well as from the inferior part of the infra-spinous aponeurosis. The muscle is directed outward to be inserted tendinously into the lowest facet of the greater tuberosity of the humerus, and, by a few fleshy fibres, upon the adjacent portion of the shaft.

Use.—To assist in outward rotation of the arm.

Nerve.—This is supplied by the circumflex humeri nerve.

Variations of the Teres Minor include fibres of origin from the long head of the Triceps muscle and the fusion of the muscle with the Infra-Spinatus. Rarely it is absent.

THE TERES MAJOR.

The Teres Major muscle arises from the quadrilateral space on the dorsal surface of the scapula near its inferior angle, and from intermuscular septa between it and the adjacent muscles. It passes upward and forward to be inserted by a thin broad tendon into the posterior lip of the bicipital groove, in close proximity with, if not actually attached to, the tendon of the Latissimus Dorsi. A small bursa is usually interposed between the two tendons.

Use.—The Teres Major raises the glenoid angle of the scapula by approximating the inferior angle to the humerus, at the same time drawing the humerus to the chest and rotating it slightly inward. Acting with the Latissimus Dorsi it depresses the elevated humerus.

Nerve.—The nerve is derived from the subscapular.

Variations prove that the Teres Major has close affinities with the Latissimus Dorsi, if it may not be considered the result of cleavage of this muscle. It sometimes fuses with the latter. It may send accessions to the fascia of the arm, or receive them from the Rhomboideus.

THE SUBSCAPULARIS.

The Subscapularis arises from the venter of the scapula throughout its extent, excepting the neck and the margin for the insertion of the Serratus Magnus.

[1] Physiologie des Mouvements, 1878.

EXPLANATION OF PLATE XLVI.

Fig. 1. The superficial muscles of the shoulder and the arm, seen from in front.

Fig. 2. The deep muscles of the shoulder, the arm, and the side of the chest. The position of the subclavius muscle is indicated, but the muscle itself is not figured.

Fig. 3. The deep muscles of the shoulder, the arm, and the chest. The pectoralis major, pectoralis minor, and subclavius muscles have been severed, the clavicle detached from the sternum, and the scapula rotated outward.

PLATE XLVI

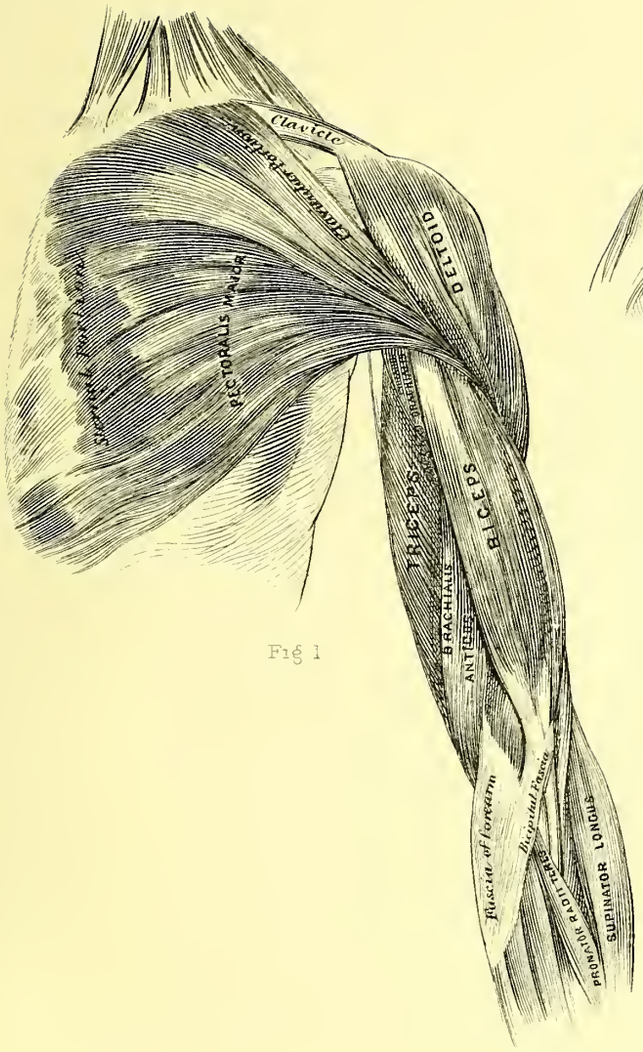


Fig 1

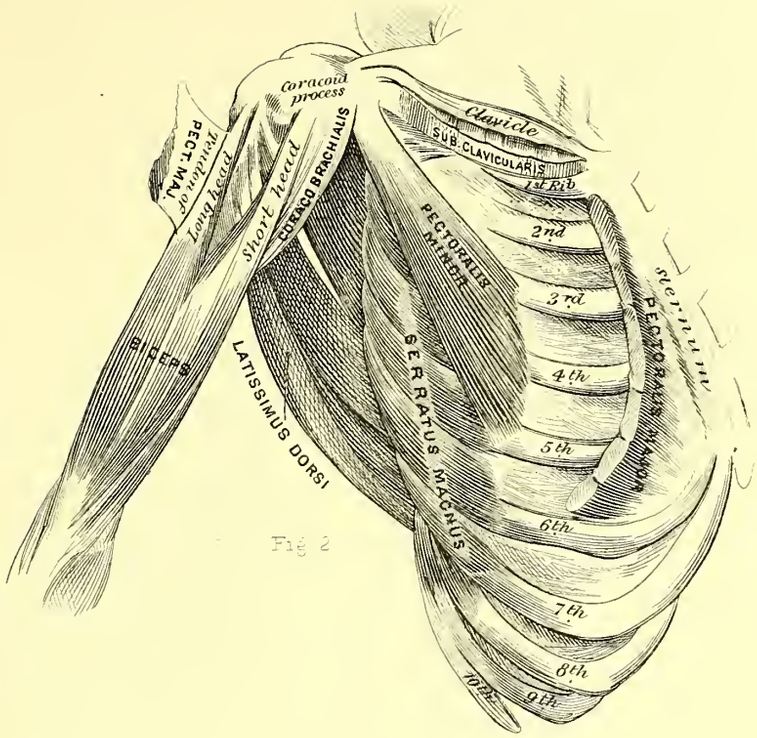
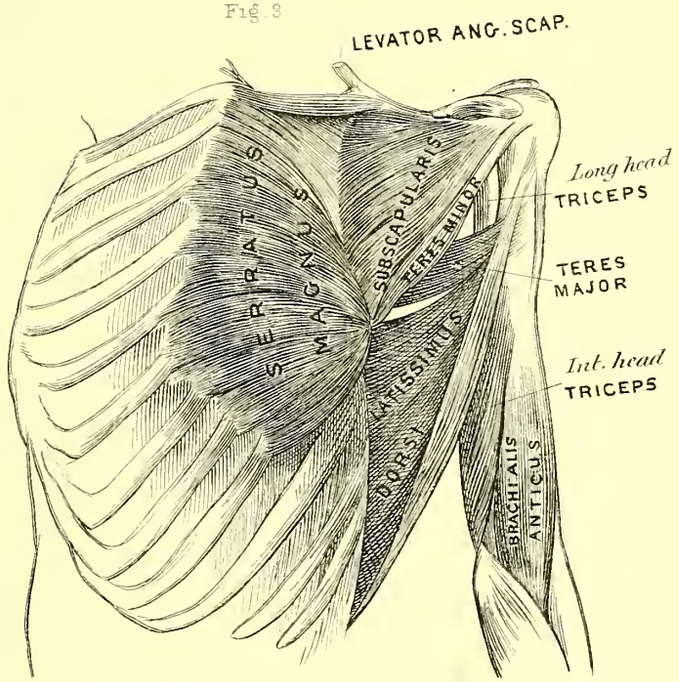


Fig 2

Fig 3



T. Sinclair & Son, Lith.

Some fibres also arise from the intermuscular septum between the Teres Major and the long head of the Triceps muscle. The muscle presents a more or less regularly fasciculated appearance, which is due to fibres arising tendinously from the minute ridges of the venter—those from the depressions between them being fleshy. The tendon is broad, and is inserted at the lesser tuberosity and at a slight distance below it on the surgical neck of the humerus. The upper part of the tendon is lost in the capsule of the shoulder-joint.

Use.—The Subscapularis rotates the humerus inward. According to Duchenne, it assists in pronation.

Nerve.—The nerve is derived from the subscapular.

Between the tendon, the neck of the scapula, and the base of the coracoid process, a bursa is seen which communicates with the shoulder-joint, and which is lined with synovial membrane.—Some of the lower fibres of the muscle terminate while still fleshy upon the humerus. Gruber compares this slip to an offshoot like that of the Teres Minor to the Infra-Spinatus muscle.—Henke asserts that the tendon is inserted into the capsule to prevent the nipping of the latter in the motions of the humerus.—The lower fibres of the muscle may be attached in part to a fibrous prolongation that completes the bicipital groove posteriorly.—The fasciculi on the venter are five in number, and present intervals within which are seen five other fasciculi, by the convergence of which the tendon of insertion is formed.

Variations.—The chief variations of the Subscapularis consist of errors in longitudinal cleavage and in an occasional accessory slip passing from the lower border of the scapula to the capsule of the shoulder-joint, or over the capsule to the humerus. Slips may be received from the Pectoralis Major.

The Muscles of the Upper Arm.

The muscles of the upper arm include—

The Coraco-Brachialis.
The Biceps Flexor Cubiti.
The Brachialis Anticus.
The Triceps.
The Anconeus.

THE CORACO-BRACHIALIS.

The Coraco-Brachialis muscle arises tendinously from the tip of the coracoid process of the scapula in common with the short head of the Biceps, and by fleshy fibres from the posterior surface of the tendon of the short head of the same muscle. The muscle is slender and flat, is directed downward and backward to be inserted into the median border of the humerus about on a level with the deltoid ridge, and by a few fibres into the internal intermuscular septum. In muscular subjects the belly of the Coraco-Brachialis can be detected when the forearm is flexed.

Use.—To carry the arm forward and inward, and at the same time to slightly elevate it. It also makes tense the internal intermuscular septum, thus rendering it a fixed surface for the origin of other muscles.

Nerve.—This is derived from the external cutaneous nerve.

A cleft usually exists in the origin and body of this muscle, permitting the escape of the musculo-cutaneous nerve.

Variations.—Among these are to be noticed: (1) The increase of the size of the cleft just mentioned, so that the entire muscle is split into two portions. (2) Rarely, the muscle or the slip to the internal intermuscular septum is absent. (3) The muscle may arise in common with the tendon of insertion of the Pectoralis Minor. (4) It may undergo imperfect planar cleavage, exhibited in short slips passing from the coracoid process to the capsule of the shoulder-joint, or to the neck of the humerus. (5) Probably belonging to the same group are the slips which pass between the tendon of the Subscapularis muscle and the brachial fascia, as well as others which pass from the tendons of the Latissimus Dorsi and Teres Major muscles to the tendon of the Coraco-Brachialis. (6) An accession may pass to the external intermuscular septum.[1]

THE BICEPS FLEXOR CUBITI.

This muscle arises by two heads, as the name expresses, and is inserted into the tuberosity of the radius.

The long or reflected head arises from the edge of the glenoid cavity, penetrates to the interior of the shoulder-joint, and winds over the head of the humerus to enter the bicipital groove, within which it is retained by a number of transverse fibrous bands. It joins the belly of the muscle, just below the inferior border of the Pectoralis Major, about the middle of the arm.—The short head arises by a broad flat tendon from the coracoid process of the scapula. It unites with the main mass at about the same point as the long head. The muscle, thus constituted, presents a conspicuous eminence on the anterior surface of the arm. Its posterior border is flattened, its anterior convex, and just above the elbow it terminates abruptly in a tendon, which is slightly twisted upon itself as it approaches its insertion upon the posterior portion of the tuberele of the radius.

A bursa mucosa is seen surrounding the long tendon of origin, and another beneath the tendon of insertion.

At the insertion of the muscle a slip of fascia (semilunar fascia) is given off from the ulnar border, and is lost upon the fascia of the forearm, which it materially strengthens.

[1] For relations of this muscle to the fascia see account of the fascia of the arm.

Both heads of the muscle are almost entirely tendinous as they lie beneath the Pectoralis Major. The tendon of insertion is robust and rounded on the outer border.

Use.—The arm being pronated, the muscle restores the forearm to supination, and then flexes the radius, and consequently the forearm. Contraction of the Biceps interferes with elevation of the humerus above the horizontal line.

Nerve.—This muscle is supplied by the external cutaneous nerve.

Relations.—The tendons of origin are covered by the Pectoralis Major and the Deltoid muscle. The body of the muscle lies beneath the skin, forming upon contraction a conspicuous mass. Behind are the humerus and the Brachialis Anticus. The external cutaneous nerve lies behind the body, and is held closely thereto, so that the finger thrust between the Biceps and the Brachialis Anticus will displace the nerve forward with the former muscle. The twigs from the brachial artery enter the posterior surface near the inner border.—On the inner side, at the upper third, the muscle lies in contact with the Coraco-Brachialis; at the lower two-thirds, in contact with the brachial artery and the median nerve. — The external cutaneous nerve becomes superficial at the outer border of the tendon of insertion. The Brachialis Anticus is visible here, the Supinator Longus lying just outside of it.

Variations of the Biceps are numerous, but are capable of the following arrangement: (1) Errors of cleavage, by which the muscle may be split in various degrees, either longitudinally, as in the belly, or in planes, as in one or both of the heads. (2) Accessions may be received from both points of origin; from the neck, the bicipital groove, the deltoid ridge, and the external condyloid ridge of the humerus; and from the internal intermuscular septum. These embrace the most frequent variations, and may occur singly, or, in some instances, together. (3) Accessions may be received from the Pectoralis Major, the Coraco-Brachialis, the Brachialis Anticus, the Supinator Longus, and the Pronator Radii Teres. (4) Slips may be sent to the Flexor Carpi Radialis, to the bursa over the tubercle of the radius, to the capsule of the elbow-joint, and to the coronoid process of the ulna. (5) The long head of the muscle, according to H. Welcker,[1] may arise from the bicipital groove. (6) The entire muscle is inserted into the ulna when the radius is absent. (7) The muscle or any of its parts may be absent. Care should be taken not to confound the effects of disease in and about the long tendon with the variations in that portion of the muscle (see group (5) of variations). Chronic rheumatoid arthritis sometimes causes the long head to be absorbed as it passes through the shoulder-joint, when abnormal attachments are in consequence established at the bicipital groove. In place of such disappearance of the long tendon, it may be found atrophied and split up into many fibrils as it passes through the shoulder-joint.—Both heads have been known to rupture, as the result of prolonged and excessive contraction.

[1] Zeit. für Anat. und Entwickelungsgesch., i. 1876, 173, fig.

THE BRACHIALIS ANTICUS.

This muscle arises on either side of the deltoid ridge, and from the anterior surface of the humerus below this point, as well as from the intermuscular septa, notably the external. The muscle passes downward and slightly inward over the anterior surface of the elbow-joint, with which it is intimately connected, and is inserted on the anterior surface of the coronoid process of the ulna.

Use.—To flex the ulna, and consequently the forearm, upon the humerus, and to draw the anterior portion of the capsule of the elbow joint forward during flexion.

Nerve.—The median portion is supplied by the external cutaneous nerve, the lateral portion by the musculo spiral nerve.

Remarks.—The muscle is fleshy at its origin at the inner aspect of the humerus, and tendinous at the outer side, where, for a short distance, it contributes to the formation of the external intermuscular septum, from which some muscular fibres arise. At and below the elbow it is fibrous. The fibres along the inner border of the muscle in part arise from the inner intermuscular septum.

Relations.—In front, the Biceps, the brachial artery and veins, and the median nerve. Behind, the humerus; on the inner side, the internal cutaneous nerve. To the outer side, above, the external head of the Triceps; between the two muscles are the musculo-spiral nerve, and the superior profunda artery and vein; below, the Supinator Longus muscle, with the same structures intervening as above.

Variations of this muscle consist of four kinds: (1) A disposition to cleavage—either longitudinal or planar. In the latter instance the deeper set of fibres may be inserted into the capsule of the elbow-joint. (2) Accessions may be received from the Coraco-Brachialis muscle. (3) Slips may be sent from the muscle to the fascia of the arm or forearm, or to the following muscles: the Supinator Longus, the Pronator Radii Teres, the Biceps, and the Flexor Sublimis Digitorum.

THE TRICEPS.

The Triceps muscle is composed, as the name expresses, of three heads. One of these arises from the axillary border of the scapula; and the remaining two from the posterior surface of the humerus. The part answering to the belly or body of other muscles is imperfectly defined. The muscle is inserted into the ulna at the olecranon.

The *scapular* or *long head* arises by a slender tendon from the axillary margin of the scapula and from the infra-glenoid tuberele. It is in close proximity to the shoulder-joint, and passes downward between the Teres Major and Teres Minor muscles to be inserted on the posterior surface of the aponeurosis of the muscle.

The *external head* arises tendinously from the posterior surface of the neck of the humerus below the great tuberosity, and by fleshy fibres from the posterior surfaee above the spiral groove and from the external intermuscular septum. Its fibres are inserted into the upper part of the external surface of the aponeurosis. Some of the fibres contribute to form the inner head.

The *internal head* arises from the posterior surfaee of the humerus below the spiral groove, and from the internal intermuscular septum. Its fibres are inserted on the deep anterior surfaee of the aponeurosis. Some of the fibres of this head are nearly horizontal.

The fibres of the *aponeurosis* converge a short distanee above the elbow-joint to form the tendon, which is thiek and massive, and which is inserted into the olecranon at its upper and posterior parts, and into an oblique ridge separating the posterior and external surfaees of the process.

Use.—To extend the ulna, and eonsequently the forearm. In this act the humeral attachments are chiefly effieient. The long head ean fix the shoulder-joint, thus aiding the Supra-Spinatus. It aids feebly in depressing the raised humerus. The long head tends to support the shoulder-joint posteriorly as the long head of the Biceps in a greater degree supports it anteriorly.

Under the name of the Subaneoneus, Theile deseribes a pair of muscular slips, which arise respeetively from the epitrochlea and epieondyle, and which are inserted upon the eapsule of the elbow-joint.—A fibrous band is deseribed by Holbertsma extending from the scapular head near its origin to the Latissimus Dorsi.

Nerve.—The muscle is supplied by the museulo-spiral nerve.

Variations in the Triceps muscle consist of additional slips of origin from the coracoid process, from the shaft of the humerus, and from the capsule of the shoulder-joint. Both fibrous and muscular accessions may be received from the Latissimus Dorsi, Teres Major, and Anconeus. The fibres of the external head may be continuous with those of the Extensor Carpi Ulnaris—an arrangement constantly seen in some quadrupeds.

THE ANCONEUS.

This musele appears to be a continuation of the outer head of the Trieeps. It is a small slip placed to the outer side of the elbow-joint. Arising from the epicondyle of the humerus, its fibres pass downward in a radiating manner to be inserted into the outer surface of the oleeranon, or to extend thenee to the upper third of the shaft of the ulna. The upper fibres are nearly horizontal, while the lower fibres are oblique.

Use.—The Aneoneus muscle assists the Trieeps in extending the forearm.

Nerve.—The muscle receives a branch of the musculo-spiral nerve.

The Variations of the Anconeus consist in fusing with the Triceps, in sending an accession to the Extensor Carpi Ulnaris, in receiving an accession from the Latissimus Dorsi, in splitting into two parts, and in sending a fascicle to bridge the ulnar nerve.

The Pronator and Flexor Muscles of the Forearm.

The Pronator and Flexor museles of the forearm embrace—

The Pronator Radii Teres.
The Flexor Carpi Radialis.
The Palmaris Longus.
The Flexor Carpi Ulnaris.
The Flexor Sublimis Digitorum.
The Flexor Profundus Digitorum.
The Lumbricales.
The Flexor Longus Pollicis.
The Pronator Quadratus.

THE PRONATOR RADII TERES.

This musele arises by two heads: one from the anterior surfaee of the epitrochlea in common with the intermuscular septum separating the Palmaris Longus and the Flexor Sublimis Digitorum, and by a slip from the aponeurosis of the forearm; the other by a slip from the inner aspect of the eoronoid process of the ulna. The median nerve passes between the heads. The musele passes downward and outward, and is inserted into the radius below the oblique line, in elose relation to the line of radial origin of the Flexor Sublimis Digitorum.

Its origin is in common with the flexor mass arising for the most part from the septum above described. The insertion is tendinous; the inner border in part is tendinous. The ulnar head is often fleshy, but has been described as tendinous.

Use.—To pronate the radius, and to assist in flexion of the forearm on the arm.

Nerve.—The muscle is supplied by the median nerve.

Relations.—In front of the humeral head lies the integument. The radial artery and nerve cross the muscle near its insertion. The muscle rests upon the Flexor Sublimis Digitorum and the radius. To its inner side lies the Flexor Carpi Radialis. The outer side forms the free edge of the flexor mass, and lies near the Brachialis Anticus.—At the ulnar head, in front, lie the radial artery and nerve. To the outer side is the Supinator Brevis; at the inner border the humeral head of the muscle. In front lies the median nerve, and behind the ulnar artery.

Variations.—The muscle may undergo cleavage in whole or in part. It may receive accessory slips, higher up the humerus, from the Brachialis Anticus and the Biceps muscles. It may be fused with the Flexor Carpi Radialis. The humeral slip may contain a sesamoid bone. The coronoid head may be absent or be duplicated. When the supratrochlear process of the humerus is present, a fibrous band passes thence to the epitrochlea, and from it arise fibres of the Pronator.

THE FLEXOR CARPI RADIALIS.

The Flexor Carpi Radialis arises tendinously from the epitrochlea, and by fleshy fibres from the intermuscular septum and the antebrachial fascia. It passes downward and laterally to become tendinous at the upper third of the forearm. The tendon enters a special sheath in the anterior annular ligament, and passing beneath the ball of the thumb is inserted upon the base of the second metacarpal bone.

Use.—To flex the carpus.

Nerve.—It is supplied by the median nerve.

The tendon embraces the palmar surface of the base of the second metacarpal bone, and gives off expansions to the trapezium.

Relations.—At its origin and throughout its proximal third the muscle forms part of the flexor mass, and lies between the Pronator Radii Teres and the Palmaris Longus. On the lateral border of the tendon lies the radial artery. Behind it is the Flexor Sublimis Digitorum.

Variations.—Slips of origin in excess may arise from the ulna below the coronoid process, from the radius, and from the Biceps muscle. The median nerve may pass between the humeral and ulnar origins. The muscle may fuse with the Pronator Radii Teres. The main tendon may be inserted into the trapezium, the scaphoid bone, the annular ligament, or into the third or the fourth metacarpal bone. A muscle representing a shifted radio-carpal flexor may arise from the radius, and be inserted into the first metacarpal and the trapezoid bones.

THE PALMARIS LONGUS.

This muscle arises from the epitrochlea by a slender tendon and from the intermuscular septa. It passes downward and forward, becomes tendinous at about the lower third of the forearm, and is inserted partly into the palmar fascia and into the fascia over the ball of the thumb (volar aponeurosis), and partly into the annular ligament. Its tendon forms an eminence above the wrist in the undissected subject.

Use.—To make tense the palmar fascia and adjacent parts, and to flex the hand. The action of this muscle may be described as a forerunner of other flexor movements.

Nerve.—It is supplied by the median nerve.

Variations.—The Palmaris Longus, while the most variable of all the muscles, presents but few distinct types of variation. It may be fused with one or more of the flexors of its own group, notably the digital and the carpo-ulnar flexors. It may undergo cleavage so that two or even three muscles exist. It appears to have close affinity with the Abductor Pollicis, since it may send accessions to it or be inserted upon it.—Slips may pass to the Abductor Minimi Digiti.—The muscle may be inserted into the ulna or the carpus; when the latter, it is inserted most frequently into the pisiform bone. It may be absent.—While this muscle is compensatory with the Flexor Carpi Ulnaris, and is held with the latter muscle in the same sheath of the deep fascia, it receives its nerve supply, not from the ulnar, but from the median nerve.

THE FLEXOR CARPI ULNARIS.

This muscle lies in the anterior and in the median part of the forearm, and extends from the epitrochlea of the humerus to the carpus and the metacarpus. Its tendon for a short distance above the wrist forms a conspicuous subrounded eminence in the undissected arm.

It arises from the epitrochlea of the humerus in common with the other superficial flexor muscles, and to a slight extent from the coronoid process of the ulna. It also arises from the posterior border and upper two-thirds of the ulna by a strong aponeurotic expansion. It passes beneath the annular ligament and is inserted into the pisiform and fifth metacarpal bones. A distinct tendinous fascicle extends from the pisiform to the unciform bone. A thin fibrous expansion is lost upon the palmar aponeurosis.

The muscle is tendinous at the inner surface for nearly its entire length. It is slightly fibrous at its origin, while its lateral border is continuous with an aponeurosis which is inserted into the ulna. Some of the fibres of the deep flexor

arise from this aponeurosis. At the upper half the tendon is enveloped by muscular fibres.

Use.—To flex the carpus, and to deflect it from the ulnar side. The statement that this muscle is an adductor of the hand is disputed by Duchenne. In the judgment of this observer, the adduction of the hand is effected by the combined action of the flexors, and is a restrained motion. There is no doubt, however, that in many of the lower animals the muscle is a true adductor.

Nerve.—The muscle is supplied by the median nerve.

Relations.—In front lie the skin and the fascia. Behind it are the border of the ulna and the fascia of the back part of the forearm. The ulnar nerve enters between its two heads, and runs along the entire extent of the muscle. The ulnar artery lies beneath it at the proximal half. The relation of the muscle to the artery is so constant that Cruveilhier calls it the satellite of the artery. A fibrous arch near the origin of the muscle affords room for the passage of the ulnar nerve and of the ulnar recurrent artery.

Between the tendon at the wrist and the pisiform bone a small bursa is exceptionally seen.

Variations.—The muscle may derive a slip from the Triceps, and send slips to the fourth metacarpal bone, to the interosseous, or the annular ligament, and to the muscles of the little finger. It may be compensatory with the Palmaris Longus. On the whole, variations are rare. In the lower animals the muscle frequently receives a slip from the Latissimus Dorsi.

THE FLEXOR SUBLIMIS DIGITORUM.

This, the most powerful of the superficial muscles of the forearm, extends from the epitrochlea of the humerus and passes to the second phalangeal row. It arises from the epitrochlea in common with the other flexor muscles, from the ulna near the coronoid process, from the anterior border of the radius by a thin membrane-like slip, and from the intermuscular septa. The muscle passes down the forearm, and divides into four tendons, each of which passes beneath the annular ligament, and is inserted into the base of the second phalanx of each of the four outer fingers. Each tendon is perforated to permit the transit of the tendon of the Flexor Profundus Digitorum.—As the muscle divides at the base of the first phalanx, two lateral processes of the tendon pass forward again to unite and to be inserted at the sides of the second phalanx. Prior to this division and insertion each tendon is inclosed in a sheath which is fixed to the sides of the phalanx. This sheath is strengthened, in front, by interlacing fibres which have received the name of the *chiasm of Camper*. The tendons themselves are strengthened by small accessory bands termed *vincula accessoria tendinum*, which are connected with the phalanges.

Use.—To flex the second and third rows of the phalanges, and these being flexed, to assist in flexing the first row and the carpus. With the aid of the Lumbricales and the Interossei, the muscle flexes the first phalanx upon the metacarpus. In the action of this muscle the flexion of the second and third phalanges must precede that of the first, a point often overlooked in studying malpositions of the fingers in flexion.[1]

Nerve.—The muscle is supplied by the median nerve.

The fibres arising from the shaft of the radius to the outer side of the Flexor Longus Pollicis form a thin lamelliform slip. The under surface is fibrous proximally where it covers the ulnar nerve.

Of the divisions of the muscle the ulnar is by far the most important. It presents a superficial and a deep set of fascicles. The superficial set is external, receives the radial slip, and yields the portions for the third and fourth fingers. The deep set is internal, and supplies the slips going to the second and fifth fingers. The tendon for the fourth finger is the largest, and that for the fifth the smallest.—The tendons are received within fibrous sheaths at about the lower border of the Pronator Quadratus. They are lined with synovial bursæ, which inconstantly communicate with the sheath of the tendon of the Flexor Longus Pollicis.

Relations.—Above lie the Flexor Carpi Radialis, the Palmaris Longus, and the Pronator Radii Teres. The radial artery runs upon the upper surface near the radius at its upper half and to the inner side at the lower half of the radius. To the outer side lies the Flexor Carpi Ulnaris. Behind the muscle is in contact with the Flexor Profundus Digitorum and the Flexor Longus Pollicis. Lying directly upon the Flexor Profundus Digitorum is the ulnar nerve. The median nerve is generally described as lying between the superficial and the deep flexor, but, more properly, it may be said to lie within the embrace of the superficial flexor.

Remarks.—In contracture of the muscle the fingers can be extended by manipulation, especially if the wrist be previously flexed.—The fibres of the muscle can be lacerated by powerful traction on one or more of the tendons, and under rare conditions a portion of a finger and the entire flexor tendon in connection therewith can be severed from their attachments.[2]

The sheath of the tendon either in the hand or the forearm may be the seat of diseased action. Synovial distension may occur, forming cyst-like collections; or

[1] W. W. Keen, Phila. Med. Times, xii. 1882, 373.

[2] T. Nunnely, Trans. Path. Soc. London, 1860, 199.

an inflammatory excitement may extend up into the forearm, a result frequently seen after amputation of any portion of a finger.

Variations.—The muscle may be fused in part with the Palmaris Longus, the Flexor Profundus Digitorum, or the Flexor Longus Pollicis.—The several slips may be separated by cleavage from one another. The slip to the fifth finger may be separate from the remaining slips.—Inscriptions may exist on one or more of the slips.—Defects are rare, and appear to be confined to the slip to the fifth finger and to the origin of the muscle from the radius. An accessory slip from the Flexor Sublimis Digitorum may rarely join the tendon of the Supinator Longus, or the muscle may itself receive a slip from the Pronator Radii Teres.

In the light of comparative anatomy, the Flexor Sublimis Digitorum is the result of a superficial planal cleavage from the Flexor Profundus Digitorum. In the majority of animals it is the smaller of the two muscles, and is often a mere superficial slip from the deep flexor.

THE FLEXOR PROFUNDUS DIGITORUM.

This muscle is situated beneath the Flexor Sublimis Digitorum to the inner side of the Flexor Longus Pollicis and on the same plane with it. It arises from the depression on the median surface of the olecranon, from the upper two-thirds of the shaft of the ulna, and from the interosseous membrane. It divides unequally at the lower third of the forearm into four tendons. The lateral slip designed for the index finger (Flexor Indicis) soon separates from the remaining three, which continue in close relation until they have passed beneath the annular ligament to the palm, when they diverge to be inserted into the bases of the last phalanges of the second, third, fourth, and fifth fingers. The tendons perforate those of the Flexor Sublimis Digitorum. They lie close to the lateral margin of the pisiform bone, and hold to it a relation similar to that held by the Flexor Longus Pollicis to the trapezium.

Use.—To flex the fingers. The action is checked by fibrous sheaths associated with the tendons as they pass beneath the annular ligament. It acts synergetically during extension of the fingers.

The anterior surface of the lower half of the muscle is occupied by broad tendons, while the upper portion is entirely muscular. A few fibres arise from the aponeurosis of the Flexor Carpi Ulnaris; these fibres are more extensive at the upper part of the ulna than elsewhere.

Relations.—Above it is the Flexor Sublimis Digitorum, and crossing the muscle obliquely is the ulnar artery. At its origin near the coronoid process it is in contact with the Brachialis Anticus. The median nerve is in part in contact with the deep flexor, but its more important relation is with the superficial. Behind are the radius, the ulna, and the interosseous membrane. To the lateral side are the Flexor Longus Pollicis and the radius. Here also are seen the anterior interosseous vessels and nerve. To the median side is the Flexor Carpi Ulnaris, and lying upon this aspect (commonly described as in front of the muscle) are the ulnar nerve and the lower part of the ulnar artery. Behind is the Pronator Quadratus.

Nerve.—The deep Flexor like the Flexor Brevis Pollicis derives its nerves from both the median and the ulnar, the supply for the index slip coming from the former and the supply for the remaining portion from the latter nerve.

For the details of this somewhat complicated muscle the reader is referred to the following:—

The muscle is susceptible of division into a lateral and a median mass, which are more or less distinct and are supplied by different nerves. The lateral longitudinal portion occupies the anterior concave surface of the ulna, and yields the slip for the index finger. It is supplied by a branch of the *median nerve*. The median portion is inclined more obliquely forward and downward, and appropriates to itself a slip from the aponeurosis of the Flexor Carpi Ulnaris. It yields the bellies for the third, fourth, and fifth fingers, and is supplied by a branch of the *ulnar nerve*. The tendons for this portion keep well together to the wrist, while the

EXPLANATION OF PLATE XLVII.

Fig. 1. The superficial muscles of the flexor surface of the forearm, seen from in front. The slender muscle to the median side of the flexor carpi radialis is the palmaris longus. The muscular fibres between the flexor carpi radialis and the supinator longus belong to the flexor sublimis digitorum. The hand is not displayed beyond the metacarpus.

Fig. 2. The deep muscles of the flexor surface of the forearm, showing also some of the muscular attachments of the superficial set, and some of the muscles of the hand. The muscles seen between the palmar tendons of the flexor profundus digitorum are the lumbricales.

Fig. 3. The superficial muscles of the lateral (radial) border of the forearm, including some of the muscles of the arm and the hand.

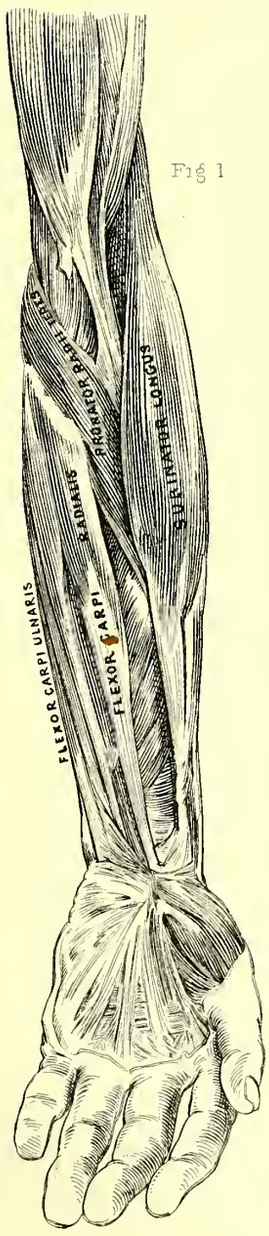


Fig 1

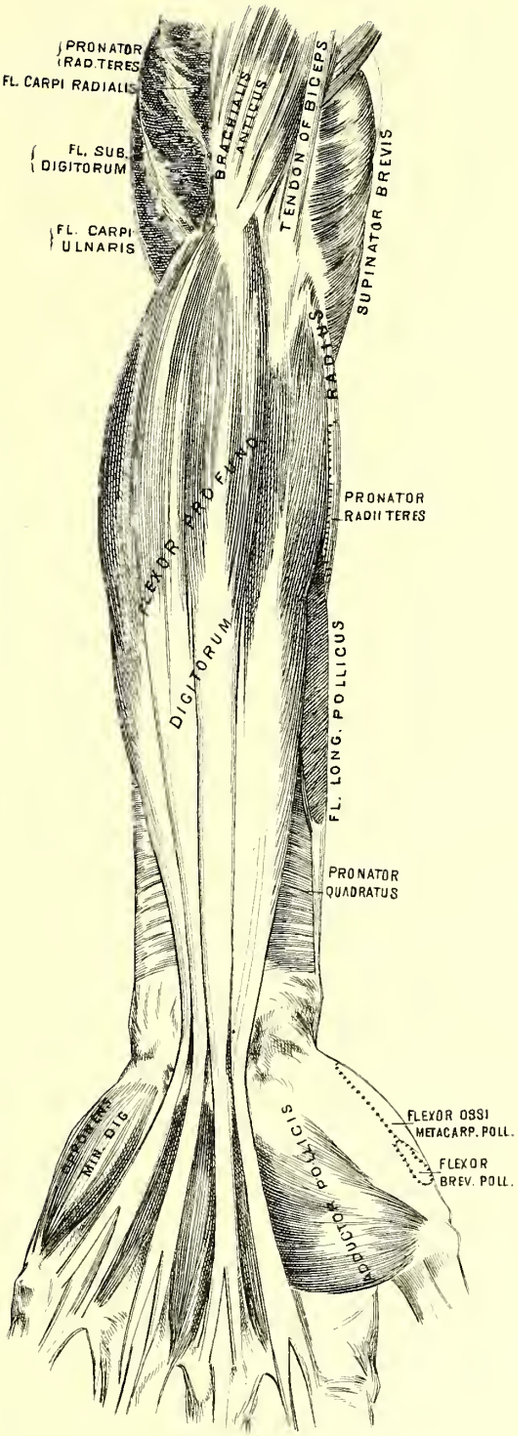


Fig 2

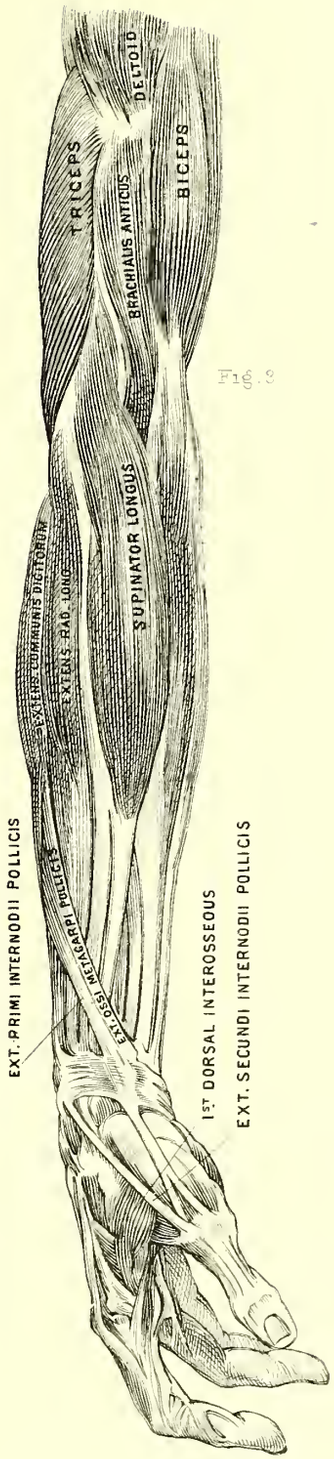


Fig. 3

T. Sinclair & Son, Lith.

tendon of the lateral portion is distinct above the wrist. According to Henle, the fourth and fifth slips are united, while the second and third are distinct.

All the tendons pass under the anterior annular ligament and diverge in the palm, each to pierce the corresponding tendon of the Flexor Sublimis Digitorum at the first phalanx of the second, third, fourth, and fifth fingers, and to be finally inserted by a broad tendon on the base of the third phalanx beneath the insertion of the capsule. As the tendon lies in the sheath with the superficial flexor it is marked by a median sulcus which is sufficiently deep to separate the tendon into two bundles. The tendon within the finger is held to the tendon of the superficial flexor and chiasmal fibres at and in advance of the carpo-phalangeal joint by one or more minute, thread-like bands (*vincula*). They are covered with the synovial vascular, villiform processes, and present concave edges. Attached to the tendons of the two Flexors are four remarkable muscles—the Lumbricales (*q. v.*).

Variations of the Flexor Profundus Digitorum embrace a cleavage by which the portion for the index finger is entirely distinct; excess of development, shown in a large surface of origin from the radius and the coronoid process of the ulna; fusion in part with the Flexor Sublimis Digitorum; insignificant variations in the origins of the Lumbricales muscles, and fusion in the forearm of the tendons for the third, the fourth, and the fifth fingers.

THE LUMBRICALES.

The Lumbricales muscles are delicate, fusiform slips, four in number, accessory to the tendons of the Flexor Profundus Digitorum. Each muscle arises from a digital division of the flexor in the neighborhood of the proximal ends of the metacarpal bones, and ending in a tendon is inserted on the dorsal aponeurosis of the fingers in close relationship with the tendons of the Extensor Communis Digitorum and the Dorsal Interossei muscles.

Use.—The Lumbricales extend the last two phalanges, and flex the first phalanx, and in these acts assist the action of the Interossei. The first Lumbrical is a feeble abductor of the first phalanx of the index finger. The function of the Lumbricales persists after the loss of flexion and extension, as seen in some forms of paralysis. They apparently give steadiness to the terminal phalanges at the same time that these distal bones are being acted upon by the tendons of the deep Flexor.

Variations.—The Lumbricales in their variations are seen to become more intimately associated with the Flexors of the fingers, particularly the deep Flexor.

Nerve.—The first and second Lumbricals are supplied by the median nerve; the third and fourth by the ulnar nerve. Thus these accessory slips of the Flexor Profundus Digitorum receive nerve supply from both the median and ulnar nerves as well as the flexor muscle itself.

THE FLEXOR LONGUS POLLICIS

arises from the anterior surface of the radius from the oblique line, as far as the tubercle, to near the upper edge of the insertion of the Pronator Quadratus. It also derives some fibres from the radial half of the interosseous membrane. It becomes tendinous at the lower third of the forearm, the tendon passing beneath the annular ligament, close to the median side of the trapezium, and is inserted into the terminal phalanx of the thumb. Its tendon in the palm closely resembles the index slip from the Flexor Profundus Digitorum. A stout fibrous border runs along the median edge its entire length.

Use.—To flex the thumb. Its tendon moves as over a pulley round the trapezium in the initiation of flexion, the thumb being forcibly extended.

Nerve.—The Flexor Longus Pollicis is supplied by the median nerve.

Relations.—Above it is the Flexor Sublimis Digitorum. Below are the radius and the Pronator Quadratus. To the inner side is the Flexor Profundus Digitorum. In the palm it lies in the large cellular interspace between the two heads of the Flexor Brevis Pollicis, but on the thumb it is confined within a sheath.

Variations.—The muscle may undergo longitudinal cleavage throughout its length. It may receive, commonly, slips from the coronoid process (some writers believe them to be constant), the internal condyle, and the Brachialis Anticus. It may send slips to the first Lumbrical, or to the deep Flexor. It may be absent. A distinct slip may arise at the radius, at the upper margin of the Pronator Quadratus.

THE PRONATOR QUADRATUS.

The Pronator Quadratus is a small square muscle lying at the lower fourth of the forearm beneath all other muscles. It arises from the inner and posterior surface of the ulna at its lower fourth and extends across the interosseous membrane toward the radius, where it is inserted upon its anterior surface and outer edge at the lower fourth of the bone. A thin fibrous expansion is often seen upon the anterior surface. It is more aponeurotic at its origin than at its insertion.

Use.—To pronate the forearm. In this act it is assisted by the Pronator Radii Teres and the Flexor Carpi Radialis. Its connection with the ulno-radial capsule may be of use in withdrawing the anterior wall from the facets during pronation.

Nerve.—The Pronator Quadratus is supplied by the anterior interosseous branch of the median nerve.

Relations.—In front are the deep flexor of the fingers, the long flexor of the thumb, and the Flexor Carpi Ulnaris. Behind are the interosseous membrane, the radius, and the ulna.—The muscle protects the distal ulno-radial articulation.

Variations.—It may be inserted into the annular ligament, or upon the end of the carpus, or it may be absent. Its variations are infrequent. The muscle is slightly tendinous on its anterior surface at the insertion. When carefully dissected it resolves itself into two (or sometimes three) subequal triangular layers. The superficial layer is inserted into the outer and anterior surface of the radius. The deep layer is inserted nearer the wrist, and influences more especially the ulno-radial capsule.

The Supinator and Extensor muscles in the region of the forearm include—

The Supinator Longus.
The Extensor Carpi Radialis Longior.
The Extensor Carpi Radialis Brevior.
The Extensor Communis Digitorum.
The Extensor Minimi Digiti.
The Extensor Carpi Ulnaris.
The Supinator Brevis.
The Extensor Ossis Metacarpi Pollicis.
The Extensor Primi Internodii Pollicis.
The Extensor Secundi Internodii Pollicis.
The Extensor Indicis.

THE SUPINATOR LONGUS.

The Supinator Longus muscle arises from two-thirds of the external condyloid ridge of the humerus at its proximal portion, and is inserted upon the lateral anterior border of the styloid process.

Use.—To flex the forearm. When previous to its action the forearm has been strongly pronated, the muscle supinates it before flexion occurs. It thus complements and assists the action of the Biceps Flexor, the two muscles acting upon separate extremities of the radius. Should the muscle contract while the forearm is supine, semi-pronation results.

Nerve.—The muscle is supplied by a branch of the musculo-spiral nerve.

The tendon extends along the proximal half of the belly, and corresponds nearly to a similar surface on the Extensor Carpi Radialis Longior. It finally is entirely free at about the middle of the forearm. The tendon at the insertion is somewhat expanded, and in part lines the groove on the radius for the Extensor Ossis Metacarpi Pollicis and the Extensor Primi Internodii Pollicis.

Relations.—Above the elbow they are as follows: It overlies the outer half of the Brachialis Anticus muscle; it is overlaid by a small portion of the Extensor Carpi Radialis Longior, and the intermuscular septum between it and the Triceps muscle. The musculo-spiral nerve lies above the elbow between it and the Brachialis Anticus, and in the forearm to its outer side. Below the elbow the muscle covers the Extensor Carpi Radialis Longior at its outer half; it covers the radial artery and vein along its median half. To the median side of its tendon lies the radial artery, to its outer side beneath the deep fascia is the radial nerve, and upon the deep fascia the anterior branch of the external cutaneous nerve.

In the Variations of the muscle there may be found a slip in common with the Extensor Carpi Radialis Longior. Its insertion may extend to the carpus, or to the third metacarpal bone. It may undergo partial cleavage. It may fuse in part with the Brachialis Anticus and the Deltoid muscles.

The Supinator Longus and the Flexor Carpi Ulnaris resemble one another in the following respects: both in part overlie the other muscles of the anterior aspect of the forearm, and both suggest close relationship with the extrinsic muscles, the Supinator Longus with the Deltoid, and the Flexor Carpi Ulnaris with the Latissimus Dorsi.

After the removal of the Supinator Longus muscle the remaining muscles of the anterior aspect of the forearm lie upon the same plane, the Flexor Carpi Ulnaris and Pronator Quadratus excepted.

THE EXTENSOR CARPI RADIALIS LONGIOR.

This muscle arises from the distal part of the external condyloid ridge and the intermuscular septum between it and the Extensor Carpi Radialis Brevior, as well as from the fascia of the forearm. The broad ribbon-shaped tendon becomes cord-like a short distance above the wrist, and is inserted upon the proximal end (base) of the dorsum of the second metacarpal bone.

Use.—To extend the carpus and incline it laterally. When the muscle is atrophied the hand is extended and adducted. Its tendon supports the joint between the trapezoid and the trapezium.

Nerve.—The muscle is supplied by a branch of the musculo-spiral.

The tendon at the belly is exposed for a short distance on the under surface.

Relations.—The muscle lies in part between the Supinator Longus anteriorly and the Extensor Carpi Radialis Brevior posteriorly, but the greater portion of the belly is subcutaneous. Behind it also lie the epicondyle in part, the head of the radius, and the Supinator Brevis. Laterally lie the Triceps and the Extensor Communis Digitorum. The tendon and the Extensor Carpi Radialis Brevior are embraced

by the same sheath, and lie in the outer of two grooves at the distal end of the dorsal aspect of the radius; and, together with the Supinator Longus and lesser radial extensor are crossed at an acute angle by the Extensor Ossis Metacarpi Pollicis and the Extensor Primi Internodii Pollicis. A bursa is seen beneath its insertion upon the second metacarpal bone.

Variations.—Among the variations of the muscle may be mentioned its fusion with the short radial extensor, or the reception of a slip from that muscle.[1] It may undergo partial cleavage, by which the tendon is duplicated.

THE EXTENSOR CARPI RADIALIS BREVIOR.

This muscle arises tendinously from the rough triangular space at the distal end of the epicondyle of the humerus, and by fleshy fibres from an intermuscular septum between it and the Extensor Communis Digitorum. The muscle passes downward to terminate in a tendon which widens slightly to be inserted on the dorsal aspect of the proximal ends of the second and the third metacarpal bones, a thin fibrous expansion being sent to the dorsum of the fourth.

Use.—To directly extend the carpus and incline it laterally.

Nerve.—The muscle is supplied by a branch of the musculo-spiral.

The muscle is tendinous at the distal half anteriorly, and at the proximal half posteriorly. The tendon grooves the pyramidal projection of the proximal end of the metacarpal bone in such a manner as to support the articulation of this bone with the trapezoid and the os magnum.

Relations.—In front, on the lateral border of the muscle, lie the Extensor Carpi Radialis Longior, and in part distally the Supinator Longus. On the median border, *i. e.*, along the line of the radius, the Supinator Brevis, the radial border of the Pronator Radii Teres, and the radial nerve. To the dorsal aspect is the Extensor Communis Digitorum. —The muscle last named is directly continuous with the Extensor, as the two muscles lie in contact with the Supinator Brevis.

A bursa commonly lies between the muscle and the Supinator Brevis, and another between the tendon and the joint uniting the second and third metacarpal bones. — The belly, above, apparently forms a continuation with the Supinator Longus.—An extension of the thin *fascia* from this muscle passes inward, covering in the upper portion of the Supinator Brevis, and is continuous in front of the elbow-joint, where it is lost in the capsule.

Variations.—The muscle presents but few variations. It may undergo longitudinal cleavage, and have as many as three tendons of insertion; the supernumerary slips may pass to the second and third metacarpal bones. It may be absent. Its origin may be intimately associated with the external lateral ligament of the elbow-joint.

THE EXTENSOR COMMUNIS DIGITORUM.

The Extensor Communis Digitorum muscle arises tendinously from the epicondyle of the humerus in common with other extensor muscles, and from the deep fascia of the forearm; also from an intermuscular septum between it and the Extensor Carpi Radialis Brevior, on the radial side, and another between it and the Extensor Minimi Digiti on the ulnar side. The muscle divides a short distance below the middle of the forearm into four tendons, which pass beneath the annular ligament, inclosed in a common synovial sheath (in common also with the Extensor Indicis), and are inserted into the backs of the phalanges of the four outer fingers. The tendons of the second, third, and fourth fingers are connected by flattened bands. A special union exists between the tendon of the fourth finger and that of the Extensor Minimi Digiti.

Use.—To extend the fingers, notably the third phalanx on the second, and to aid in the lateral motions of the fingers. The extension of the first phalanges places the second and third phalanges in a favorable position for apposition of the finger tips with the extremity of the thumb.

Nerve.—The muscle is supplied by a branch of the musculo-spiral.

One or more minute fibrous bands, called *vincula*, pass between each tendon and the phalanges.—The muscle is thin and tendinous at its origin.—The tendon for the third finger is the most powerful.

Relations.—The muscle is free upon the posterior surface of the forearm. Beneath it lie the Supinator Brevis, the extensors of the thumb, and the Extensor Indicis. To the lateral side, above, is the Extensor Carpi Radialis Brevior; below, are the Extensor Carpi Radialis Longior and the extensors of the thumb. To the median side is the Extensor Minimi Digiti.

The tendons are arranged in pairs at the annular ligament, the two central tendons, and the slips for the fourth and fifth fingers remaining together. The outer fasciculus, lower down, is placed in front of the middle fasciculus. The external and internal tendons answer to the interosseous spaces, which they cross obliquely in order to assume a position behind the head of the metacarpal bones to which they belong. The manner of insertion of each tendon on the phalanges is as follows: The tendon, as it passes the meta-

[1] Welcker (Zeitschr. für Anat. und Entwickelungsgesch., 1876, 173) proposes to call all slips of muscular fibre passing between two muscles of the same group *conjugate fasciculi*, since they seem to yoke or bind the two muscles. Conjugate fascicles indicate that the process of differentiation of two muscles from a generalized ancestor has been imperfectly accomplished. They will sometimes be found present in a muscle like the Semimembranosus of the raccoon, when the two main bundles united by them are not separately named.

carpo-phalangeal articulation, is inserted into the base of the first phalanx. Beyond the metacarpo-phalangeal articulation the tendon divides into three fasciculi, two lateral and one central. The former, more robust, embrace the first phalangeal articulation to unite at the proximal extremity of the terminal phalanx. The middle fasciculus is inserted on the base of the second phalanx, and receives accessions from the tendons of the Lumbricales and the Interossei, which converge from both borders of the fingers beneath the lateral fasciculi, *i. e.*, between them and the bones, and are inserted into the central tendon. The membrane formed by these agencies is called "the dorsal aponeurosis."

Variations.—The variations of this muscle embrace the following: (1) A tendency to excess in the tendons of insertion. This is most frequently witnessed in the tendons of the second and third fingers, but may occur in all. (2) A tendency to longitudinal cleavage, by which each of the fingers may be extended by a separate muscle. (3) The muscle may fuse with the Extensor Indicis and the Extensor Secundus Internodii Pollicis, and send slips to the Extensor Carpi Ulnaris and Extensor Minimi Digiti. (4) The tendons of the second and fifth fingers may be absent.

THE EXTENSOR MINIMI DIGITI

arises by a thin tendon in common with the Extensor Communis Digitorum, from the external condyle of the humerus and the fascia of the forearm. It also arises from the ulna by a coarse thin tendon between the Anconeus and the Supinator Brevis, and from the septa between the muscle and the Extensor Communis Digitorum and the Extensor Carpi Ulnaris. It rests upon the Supinator Brevis. When isolated from its relations, it presents a coarse fibrous appearance at the sides. A short distance above the wrist the muscle forms a tendon, which passes through a distinct fibrous canal behind the radio-carpal articulation, and, joining the fourth tendon of the common extensor, is inserted into the base of the first phalanx of the little finger.

Nerve.—The muscle is supplied by a branch of the musculo-spiral nerve.

Use.—To extend the first phalanx of the fifth finger and, according to Duchenne, to adduct it.

Variations.—This is an exceedingly variable muscle. It may be wanting. It often forms two tendons, which subsequently reunite; or, remaining separate, pass to the fourth and fifth fingers. The tendon may split just below the annular ligament into two, which subsequently unite at the base of the fifth finger, or the cleavage may be complete. The radial slip may join a tendinous slip from the Extensor Communis Digitorum. Thus the muscle cannot extend the fifth finger entirely without assistance from the Extensor Communis Digitorum.

THE EXTENSOR CARPI ULNARIS

arises by a thin slip from the epicondyle of the humerus, from the aponeurosis of the forearm, from the septum between it and the Extensor Minimi Digiti, and from the shaft of the ulna as far as its middle third. The muscle inclines somewhat to the ulnar side of the forearm, and ends in a tendon which is free at the inferior third of the forearm. This tendon runs within a deep groove upon the posterior surface of the ulna between the articular surface and the styloid process, and is inserted into the base of the fifth metacarpal bone.

Its superficial surface is conspicuously occupied by an aponeurotic membrane nearly its entire length. The lower third of its deep surface is tendinous. The tendon is stouter than any of the tendons of the common extensor.

Use.—To extend the carpus as well as to elevate and adduct the hand.

Nerve.—The muscle is supplied by a branch of the musculo-spiral nerve.

Relations.—The lower portion of the belly and the tendon lie loosely secured in a sheath; the anterior wall being the ulna, while the posterior wall is united to the ulna by fibrous tissue. At the wrist the tendon is in common or nearly so with the tendon of the Extensor Minimi Digiti. In the forearm the two muscles are separated by a septum. Beneath the upper end of the muscle a bursa is occasionally seen (Meckel).—According to Luschka the Extensor Carpi Ulnaris is analogous to the slip in the leg, which joins the Extensor Minimi Digiti to the Peroneus Brevis.

The muscle is covered by integument above; it lies upon the convergent surfaces of the Anconeus, and Extensor Communis Digitorum above, to which it is slightly attached. Below it rests upon the ulna, the fibres of origin of the Extensor Secundi Internodii Pollicis and those of the Extensor Indicis. To its radial side lies the Extensor Communis Digitorum; to its inner the Supinator Brevis above, and the Flexor Carpi Ulnaris below.

The Variations are, as a rule, infrequent. It is compensatory with the Extensor Minimi Digiti. It receives an accession from the Triceps. Its tendon furnishes a surface of origin for the Abductor Minimi Digiti. It may send accessions to the fascia of the dorsum of the hand, especially along the median border of the fifth metacarpal bone, and to the dorsal aponeurosis of the fifth finger. Some writers believe these fibres to be constant.

THE SUPINATOR BREVIS.

This muscle arises from the external lateral ligament of the elbow-joint, from the orbicular ligament, from the posterior border of the shaft and a depression

beneath the lesser sigmoid notch of the ulna, and from the deep fascia. The muscle passes obliquely downward and inward, closely following the radius, to be inserted into the oblique line, and into the neck of that bone.

Use.—To supinate the radius and directly antagonize the Pronator Radii Teres.

Nerve.—The muscle is supplied by a branch of the posterior interosseous.

The muscle is single at its origin, but soon becomes bilaminate. The superficial lamina forms the greater portion of the muscle. It is composed of longer and more oblique fibres, and contains on the surface a few coarse tendinous slips. It is pierced by twigs of the posterior interosseous artery. The deep lamina is situated near the head, is almost entirely muscular, and contains proximally some horizontal fibres. The posterior interosseous nerve lies in the interlaminate space, and in dissection is lifted up with the superficial lamina.—A few tendinous slips descend vertically on the muscle from the epicondyle.

Relations.—Anteriorly lie the bellies of the Extensores Carpi Radiales Longior and Brevior, and the radial artery. Posteriorly are the elbow-joint and the radius. Directly upon its distal border is the tendon of insertion of the Pronator Radii Teres. Laterally lies the Extensor Communis Digitorum.—A bursa lies between it and the Extensor Carpi Radialis Brevior.

Variations.—It may contribute slips to the Biceps and the Pronator Radii Teres.

THE EXTENSOR OSSIS METACARPI POLLICIS.

This muscle arises from the elongated depression on the posterior surface of the ulna below the origin of the Supinator Brevis, from the interosseous membrane, from the middle third of the posterior surface of the radius, and from a septum between the muscle and the Flexor Longus Pollicis. It is inserted upon the posterior aspect of an aponeurosis which becomes condensed into a flat tendon, turning obliquely round the radial border of the forearm (over the tendons of the Supinator Longus and of the extensors of the carpus), and, passing along the lateral groove at the distal end of the radius in company with the tendon of the Extensor Primi Internodii Pollicis, ends on the radial border of the distal end of the first metacarpal bone.

Use.—To move the first metacarpal bone outward and forward. Albinus (and, following this authority, Continental writers) named the muscle Abductor Longus Pollicis from the fact that the thumb under its contraction is drawn away from the axis of the hand, the muscle in this respect acting in common with the Abductor Pollicis. The two muscles are often more or less fused (see Variations).

Nerve.—It is supplied by a branch of the posterior interosseous.

The groove containing the tendon is converted into a canal by a stout prolongation of the posterior annular ligament. A bursa lies between the tendon and the radial extensors.

Variations.—The muscle is often fused in part with the Abductor Pollicis. It frequently undergoes partial longitudinal cleavage; one tendon passing to the metacarpal bone, and the other joining the Opponens Pollicis. It may be inserted in part upon the trapezium. In some mammals, with a rudimentary first metacarpal bone, it may pass entirely to the carpus.—It was thought best in the text to follow the description usually given by writers respecting the tendon of this muscle. It is probable that more than a single tendon will be found present in the majority of instances.

THE EXTENSOR PRIMI INTERNODII POLLICIS.

This muscle is much smaller than the preceding. It arises from the radius and the interosseous membrane near the middle of the forearm. The tendon accompanies the Extensor Ossis Metacarpi Pollicis, and is received within the same groove on the posterior surface of the radius. It passes downward on the lateral aspect of the carpus, and is inserted by a thin tendon on the aponeurosis of the dorsal surface of the first phalanx of the thumb.

Use.—To extend the first phalanx upon the first metacarpal bone. When this act is complete, the muscle can abduct the thumb.

The Extensor Ossis Metacarpi Pollicis and the Extensor Primi Internodii Pollicis act on the thumb in the line of the radius, the stout prolongation of the posterior annular ligament acting as a pulley to the tendon.

Nerve.—It is supplied by a branch of the posterior Interosseous.

Relations.—The muscle lies to the ulnar side of the Extensor Ossis Metacarpi Pollicis.

Variations.—The muscle is an inconstant one, being found in about five per cent. of subjects. It is peculiar to man. The tendon may be continuous in part with the Abductor Pollicis or the Extensor Ossis Metacarpi Pollicis. A tendinous slip may pass to the base of the first metacarpal bone.

THE EXTENSOR SECUNDI INTERNODII POLLICIS.

This muscle arises from the crest and the posterior surface of the middle third of the ulna, and from the distal portion of the interosseous membrane. The tendon crosses obliquely the sheaths of the extensors of the carpus. It is free directly above the annular ligament, and enters a narrow oblique groove on the posterior surface of the end of the radius to be in-

serted on the base of the second phalanx. The tendon is inclosed in a distinct sheath.

Use.—To extend the terminal phalanx, and indirectly the entire thumb.

The muscle may be regarded as a differentiation from the Extensor Communis Digitorum, and is to the thumb what the Extensor Indicis is to the index finger. Hence its isolation from the Extensor Ossis Metacarpi Pollicis and the Extensor Primi Internodii Pollicis.—A number of tendinous slips of origin are often noticed which have not been included in the description.—The tendon lies halfway within the muscle.

Relations.—The muscle lies beneath the Extensor Communis Digitorum. Beneath it lie the interosseous membrane and the ulna. To the radial side are the Extensor Ossis Metacarpi Pollicis and Extensor Carpi Radialis; to the ulnar side the Extensor Indicis and Extensor Carpi Radialis Brevior. The tendon crosses the sheath of the tendon of the Extensor Carpi Radialis Longior over the first interosseous space to gain the median edge of the first metacarpal bone.

Variations.—The muscle may undergo entire cleavage, or develop more than one tendon. The insertion may advance along the thumb. It may partially fuse with the Abductor Pollicis.

THE EXTENSOR INDICIS.

This muscle arises from about the lower third of the posterior surface of the ulna and from the interosseous ligament, and is inserted on the last two phalanges of the second finger. The tendon enters the sheath of the Extensor Communis Digitorum as far as the carpus.

Use.—To extend the second finger at the first phalanx. It may, in this connection, act conjointly with the Extensor Communis Digitorum. Duchenne detected a slight abducting power in the muscle when faradized.

Nerve.—It is supplied by a branch of the posterior interosseous.

The posterior surface of this muscle, as it lies beneath the fibrous surface of the Extensor Carpi Ulnaris, is distinctly fibrous. This layer is continuous with the intermuscular septum to the outer side of the Extensor Communis Digitorum.

Relations.—Above it lies the Extensor Carpi Ulnaris; below, the muscle rests upon the interosseous membrane. To the radial side lies the Extensor Secundi Internodii Pollicis, and to the outer side, the ulna.—The tendon crosses the carpus and the second interosseous space obliquely, and lies to the median side of the tendon given off to the index finger by the Extensor Communis Digitorum.

Variations of this muscle embrace the following:—

(1) Errors by excess, by which the third and fourth fingers receive tendons. (2) Excess of cleavage, by which the belly may be divided throughout, or the tendons be duplicated. (3) Accessions, received from the Extensor Communis Digitorum. (4) Errors by defect, by which the muscle arising from the radius, may be inserted on the fascia of the hand, or may be absent.

The Muscles of the Hand.

The muscles of the hand include those of the—

- Palm.
  - The Palmaris Brevis.
- Thumb.
  - The Abductor Pollicis.
  - The Opponens Pollicis.
  - The Flexor Brevis Pollicis.
  - The Adductor Pollicis.
- Fifth Finger.
  - The Abductor Minimi Digiti.
  - The Flexor Brevis Minimi Digiti.
  - The Opponens Minimi Digiti.
- Interossei.
  - The Dorsal Interossei.
  - The Palmar Interossei.

THE PALMARIS BREVIS.

The Palmaris Brevis is a small muscle of a quadrilateral form. It arises from the ulnar margin of the palmar fascia and the annular ligament, and is inserted upon the skin toward the ulnar border of the palm.

Use.—To assist in deepening the palm in the act of opposing the first and fifth fingers. Duchenne assigns to it a function of flexing the hand, and believes it to be second only in importance in this act to the Palmaris Longus.

Nerve.—The muscle is supplied by the ulnar nerve, a number of branches commonly underlying it.

Variations.—Commonly inconspicuous, it is rarely absent. The numerous reported instances of its absence are thought by Macalister to be errors in observation. It may secure attachment from the pisiform bone, and is of unusual size when the Palmaris Longus is absent. Some fibres may reach the hypothenar eminence.

THE ABDUCTOR POLLICIS.

This muscle arises from the trapezium and the annular ligament. It is a flat muscle forming the greater part of the superficies of the ball of the thumb. The fibres pass downward and outward and are inserted by a broad thin tendon on the lateral border of the first phalanx of the thumb near the dorsum, and are in part continuous with the expansion of the dorsal aponeurosis.

Use.—To abduct the thumb. It is assisted in this act by the superficial head of the Flexor Brevis Pollicis and the Opponens Pollicis.

Relations.—A very narrow cellular line separates it on the median side from the superficial head of the Flexor Brevis Pollicis, which is situated on the same plane. It covers the Opponens Pollicis, from which it can be distinguished by the direction of its fibres, and by a thin intervening aponeurosis.

Variations.—The muscle may undergo longitudinal cleavage. It frequently receives a fibrous slip from the Extensor Ossis Metacarpi Pollicis, and a muscular slip from the styloid process of the radius. A slip may be inserted into the skin. The trapezoid fibres may be absent.

The subcutaneous section of the tendon of this muscle should be essayed, according to Holden,[1] at a point one inch above its insertion.

THE OPPONENS POLLICIS.

The Opponens Pollicis muscle (Flexor Ossis Metacarpi Pollicis) arises from the anterior annular ligament in front of the Flexor Carpi Radialis and Palmaris Longus muscles, as well as from the ridge of the trapezium. The muscle is directed outward and is inserted for the most part by fleshy fibres, along the entire extent of the lateral border of the first metacarpal bone.

Use.—To flex and abduct the first metacarpal bone. The term *Opponens*[2] has been given this muscle, and the Opponens Minimi Digiti under the supposition that these are the chief muscles engaged in *opposing* the first and fifth metacarpal bones. It is inaccurate to confine the term to the Opponens Pollicis, since its action in this regard cannot be separated from that of the Abductor Pollicis and the deep head of the Flexor Brevis Pollicis.

THE FLEXOR BREVIS POLLICIS.

The Flexor Brevis Pollicis muscle is composed of two portions, a superficial and a deep. The *superficial portion* arises by fleshy and tendinous fibres from the annular ligament. The *deep portion* arises from the trapezium and os magnum, from the sheath of the Flexor Carpi Radialis, and from the proximal ends of the second and third metacarpal bones. The deep narrow interspace between the heads is occupied by the tendon of the Flexor Longus Pollicis. The two portions are commonly united by a conjugate fascicle, but each division is inserted separately upon the proximal end of the first phalanx of the thumb, the superficial portion to the lateral and the deep to the median side. A sesamoid bone lies within each tendon.

Use.—To flex and abduct the first phalanx of the thumb.

Nerve.—The superficial portion is supplied by the median and the deep portion by the ulnar nerve.

The superficial portion is thus a member of the abductor set of muscles (including the Extensor Ossis Metacarpi Pollicis, Abductor Pollicis, and Opponens Pollicis) with which it is in intimate association. The deep portion is a true adductor, and is to be studied in connection with the Adductor Pollicis. This fact has long been insisted upon by French anatomists, and has received endorsement from Duchenne in his studies of the electrization of muscles in the living subject.—Hyrtl's statement that the muscle is analogous to the Flexor Sublimis Digitorum—the long flexor being analogous to the Flexor Profundus Digitorum—cannot be sustained.

Relations.—The superficial portion is on a level with the Opponens Pollicis, while the deep is on a level with the Adductor Pollicis. The former overlaps the Adductor Pollicis at the lateral edge. The branches of the median nerve for the thumb cross it.

Variations.—The superficial portion at its origin is in part united with the Opponens Pollicis. It may fuse with the Abductor Pollicis. The entire muscle may be absent.

Remarks.—The mechanism of backward dislocation of the first phalanx of the thumb has been carefully studied by Fabbri,[1] and, since it brings into play anatomical peculiarities of the short flexor of the thumb, may be here described:—

"The first phalanx, as it moves backward, takes with it the two heads of the Flexor Brevis Pollicis, and the sesamoid bone developed in them; the anterior and the lateral ligaments of the joint are torn off from the head of the metacarpal bone, which tears a way for itself through the fibrous tissue uniting the two heads of the Flexor Brevis, between which it projects as a button does out of a buttonhole."

THE ADDUCTOR POLLICIS.

This irregularly triangular muscle arises from the anterior two-thirds of the palmar surface of the metacarpal bone of the middle finger, and by a fasciculus from the anterior part of the carpus. The fibres from this extensive origin converge outward to form a short tendon to be inserted with the deep head of the Flexor Brevis Pollicis through the medium of the sesamoid bone into the base of the first phalanx of the

[1] Landmarks, 103.

[2] It has become customary for anatomists to name any group of muscular fibres intrinsic to the hand or foot, and which may be inserted upon the palmar or plantar surfaces of the metacarpal or metatarsal bones, an *Opponens*, entirely irrespective of function.

[1] Memoire dell' Accad. delle Scienze dell' Instituto di Bologna, vol. x. See also T. Holmes, Surgery, 286.

thumb, and on the capsule of the metacarpo-phalangeal articulation.

Use.—When the thumb is flexed on the carpus the muscle is an extensor; when the thumb is abducted it acts as a flexor and draws the thumb forward and inward; or it may adduct the thumb. It commonly acts in conjunction with the deep head of the Flexor Brevis Pollicis.

Nerve.—The muscle is supplied by the ulnar nerve.

Relations.—Above it lie the flexor tendons of the index finger, with the first lumbrical muscle, the deep head of the short flexor, and the branches of the median nerve to the thumb. Behind it lie the deep palmar arch, and the first dorsal interosseous muscle.

Variations.—The carpal origin may be attached to the trapezium, to the os magnum, and to a fibrous arch extending from the trapezium to the base of the first phalanx. The metacarpal origin may include fasciculi from the fourth and fifth metacarpal bones.

THE ABDUCTOR MINIMI DIGITI.

This muscle arises from the distal half of the pisiform bone, and from the termination of the tendon of the Flexor Carpi Ulnaris. It is inserted on the ulnar border of the first phalanx of the little finger, a slip passing to the dorsal aponeurosis.

Use.—To abduct the little finger from the axis of the hand.

Nerve.—It is supplied by the ulnar nerve either from the deep or the superficial palmar branch.

Variations.—The muscle may have an origin from the ulna. All slips of origin may be absent, save that from the pisiform bone. The muscle may be absent. A muscle described by Gruber, extending from the hamular process of the unciform bone to the pisiform bone, is probably the result of cleavage of the above muscle. It may fuse in part with the Opponens Minimi Digiti. It may arise bipenniform from the inferior third of the lateral margin of the ulna, and, passing beneath the annular ligament, lie to the lateral side of the Adductor of the same finger, and have an insertion in common with it (Günther).

THE FLEXOR BREVIS MINIMI DIGITI.

This narrow muscular slip arises from the ulnar side of the uncinate process of the unciform bone, and from the annular ligament. Its fibres pass forward to be inserted at the base of the first phalanx of the little finger. To its radial side lies the superficial branch of the ulnar artery.

Use.—To flex the little finger.

Nerve.—The nerve is derived from the ulnar.

Variations.—The muscle may receive an accession from the Palmaris Longus. It may have no origin from the annular ligament. It may be fused with the Abductor Minimi Digiti.

THE OPPONENS MINIMI DIGITI.

The Opponens Minimi Digiti muscle arises from the uncinate process of the unciform bone and from the annular ligament. It is inserted along the entire ulnar border of the fifth metacarpal bone.

Use.—To draw the fifth metacarpal bone forward and toward the median line of the palm. This movement is sometimes spoken of as one of abduction since the little finger is drawn away from the fourth.

Nerve.—The nerve is derived from the ulnar.

The muscle is slightly tendinous at both origin and insertion. It lies beneath both the preceding muscles.

Variations.—The muscle may be fused with the Abductor Minimi Digiti. It may undergo entire cleavage. It may be absent.

THE DORSAL INTEROSSEI.

The Dorsal Interossei muscles are four in number. They are best seen from above, where the dorsal surfaces occupy the interosseous spaces on a level with the plane of the back of the metacarpus. Each muscle is bifid at the proximal end, the main portion arising from the metacarpal bone corresponding to the phalanx on which it acts. The short tendon is in each instance inserted into the border of the base of the first phalanx, and, also, by a fibrous sheet, into the delicate dorsal aponeurosis.

Use.—The Dorsal Interossei are all abductor muscles. The first of the series constitutes the fleshy mass that can be felt in the hand between the first and second fingers.

The following includes the description of each of the four muscles:—

The first muscle is the largest. Its first head—the outer and larger—arises from the upper half of the median border of the first metacarpal bone; the second from the entire length of the lateral surface of the second. The tendon joins the extensor of the index finger on its lateral aspect.—The radial artery descends to the palm between the two heads of this muscle. A bursa is described by Synnestedt as lying beneath the tendon.

The second muscle arises by its first head from the ulnar border of the second metacarpal bone, and by its second from the radial border of the third. Its tendon joins the lateral border of the extensor tendon of the middle finger.

The third muscle arises by its first head from the ulnar border of the third metacarpal bone, and by its second from the lateral border of the fourth metacarpal. Its tendon is inserted on the lateral border of the extensor tendon.

The fourth muscle arises by its first head from the median border of the fourth metacarpal bone, and by the second from the lateral border of the fifth metacarpal bone. Its tendon is inserted on the median border of the ring finger.

The fascieuli of each muscle arise from either side of the ridge marking the second and the third metacarpal bone, as well as from the lateral side of the fifth metacarpal bone and the median side of the corresponding bone of the thumb.

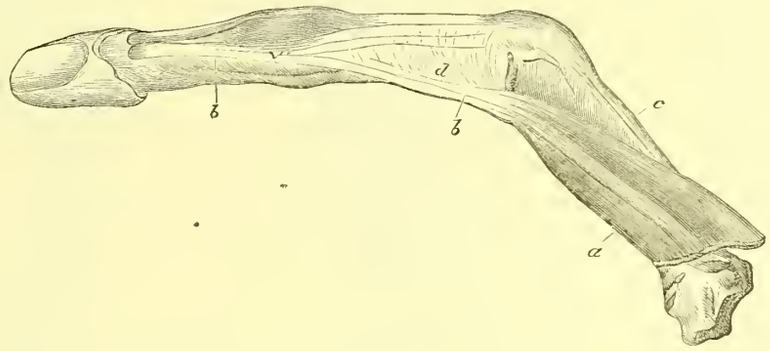
THE PALMAR INTEROSSEI.

The Palmar Interossei muscles are three in number and are situated on the palmar aspect of the metacarpus. Each muscle is short and prismatic, and pursues a course parallel with the axis of the hand to terminate in a small tendon which is inserted on the base of the first phalanx, and on the dorsal aponeurosis of the finger from whose metacarpal bone the muscle arises.

The first muscle arises from the median side of the second metacarpal bone. The second and third muscles arise from the lateral side of the fourth and the fifth metacarpal bone respectively. The third finger is thus free from palmar attachments.

Use.—To adduct the fingers, and, with the Lumbricales, to assist in extending the second and third phalanges of the fingers. The dorsal Interossei abduct the second, third, and fourth fingers. The Palmar Interossei adduct the second, fourth, and fifth fingers. These muscles, when powerfully excited by an electrical current, flex the first phalanx of each finger on the corresponding metacarpal bone, and, by means of the slips passing to the dorsal aponeuroses (Fig. 77, and fig. 2, Plate XLIX.), extend the second and third phalanges. The fourth finger is flexed at the first phalanx chiefly by the fourth Dorsal Interosseous muscle.

Fig. 77.



THE FOURTH FINGER OF THE LEFT HAND, WITH ITS DORSAL INTEROSSEOUS OR ADDUCTOR.—*a*. Dorsal interosseous or adductor. *b*, *b*. Phalangeal tendon of the dorsal interosseous. *c*. Tendon of the common extensor of the fingers. *d*. Aponeurotic expansion uniting the phalangeal tendon of the interosseous to the tendon of the common extensor of the fingers.

The muscles are thus seen to assist the lumbrical muscles in some of their movements, and the digital flexors and extensors in others.

Duchenne[1] has paid special attention to these muscles, both in their physiological and clinical relations. According to this authority, individuals who have lost the use of the Interossei and the Lumbricales, can neither extend the second and third phalanges nor flex the first, while those who have lost the use of both the flexors and extensors (properly so named), can yet flex the first phalanges and extend the second and third.

These muscles do not entirely fill the spaces in which they are found, thus permitting a portion of each Dorsal Interosseous muscle to appear at their sides.

The first dorsal, according to Henle, receives a slip of origin from a tendinous arch which runs over the deep branch of the radial artery from the anterior surface of the trapezium to the dorsal surfaces of the bases of the first two metacarpal bones.

Neither the palmar nor the dorsal Interossei appear to be endowed with a high degree of sensibility. Portal refers to instances of religious fanatics and mountebanks piercing the interosseous spaces without appearing to suffer much from the self-inflicted wounds.

Nerve.—The Interossei, both Palmar and Dorsal, as well as the Flexors and Abductors of the thumb, receive their nerve supply from the ulnar nerve, and are paralyzed after its section.

Each Interosseous muscle is a remnant of the Metacarpo-phalangeal Flexor of quadrupeds. This muscle as it exists in the cat, consists of a single metacarpal belly and two heads, each being inserted into the border of the base of the first

[1] Physiologie des Mouvements.

phalanx through the medium of a sesamoid bone. In the human subject the muscle appears in the hand only in the Flexor Brevis Pollicis. But if the Interossei be examined with this ideal muscle before the mind, it will be seen (conceding the sesamoid bone to be lost, and the belly of the muscle to have undergone longitudinal cleavage) that the flexor is represented in the second finger by the first Dorsal Interosseous on the lateral border, and by the first Palmar Interosseous on the median. In the third finger, both the elements are represented in the second and third Dorsal Interossei. In the fourth the lateral element is seen in the second Palmar, and the median in the fourth Dorsal. In the fifth finger the Flexor Brevis Minimi Digiti represents the median portion of the common Flexor, the lateral being in this instance the third Palmar Interosseous.

(2) The Fasciæ.

The fascia of the upper extremity is freely continuous with the fascia of the trunk by means of that covering the Pectoralis Major, the Deltoid, and the Latissimus Dorsi muscles. It is weak as it lies upon these muscles; it is better developed upon the arm, and best developed in the region of the hand. It is strengthened by slips from the Biceps Cubiti and Palmaris, and by septal slips passing down to the scapula and the bones at and below the elbow-joint. It affords surfaces of origin to many of the muscles.

The lines of union between the exserted portion of the upper extremity (namely, from about the insertion of the Pectoralis Major) and the trunkal portion (namely, the portion at the sides of the trunk held by the clavicle and the scapula) are marked by two fasciæ that demand separate description.

These are—

The Axillary Fascia.
The Costo-Coracoid Fascia.

The Axillary Fascia is a thin sheet covering the axilla, and is continuous at the sides with the fascia covering the adjacent muscles. It incloses and protects the lymphatics, a deeper layer overlying the axillary vessels and nerves, and is in part continuous with the insertion of the Pectoralis Minor and with the origin of the Coraco-Brachialis muscle. It is in part also attached to the coracoid process, and is continuous with the coraco-clavicular fascia. Occasionally delicate arched muscular fibres cross the axillary fascia from the Latissimus Dorsi to the Pectoralis Major muscle.

The Costo-Coracoid fascia is included among the deep fasciæ of the upper extremity. It lies between the under surface of the clavicle and the coracoid process, passes inward and downward, and divides into two layers which are inserted upon the under surface of the clavicle between the coracoid and the rhomboid ligaments. Between the two layers of coraco-clavicular fascia is lodged the Subclavius muscle. The superior layer is thicker than the inferior, and passes without union with the latter to the coracoid process. At its point of origin the fascia sends a thin expansion to the brachial fascia at the axilla, where a deeper portion enters into the sheath for the axillary vessels. Lying above the coracoid attachment is the origin of the Pectoralis Minor muscle. The fascia serves to protect the parts escaping beneath the clavicle, and to support the already stout bands of union between the clavicle and the scapula. The finger cannot be passed far under the bone in consequence of the presence of this membrane. An offshoot from the upper surface of the membrane is continuous with the fascia over the Pectoralis Minor muscle.

Fascia of the Arm.—The fascia over the Biceps muscle is thicker than that over the Brachialis Anticus and the Supinator Longus. With the last-named muscle it is closely incorporated. It becomes stouter near the elbow, where it is continuous with the fascia of the forearm. The fascia over the Triceps muscle is in turn thicker than that over the Biceps,

EXPLANATION OF PLATE XLVIII.

Fig. 1. The same, in part, as Fig. 2, Plate XLVII., but from the opposite side of the body. The flexor longus pollicis and the flexor carpi ulnaris are retained in position, and the insertion of the supinator longus is seen. The hand is drawn entire throughout, and its superficial muscles displayed.

Fig. 2. The superficial muscles of the forearm, seen from behind; the hand and the lower portion of the arm are displayed.

Fig 3. The superficial muscles of the lateral (radial) border of the forearm, together with some of the muscles of the hand.

PLATE XLVIII

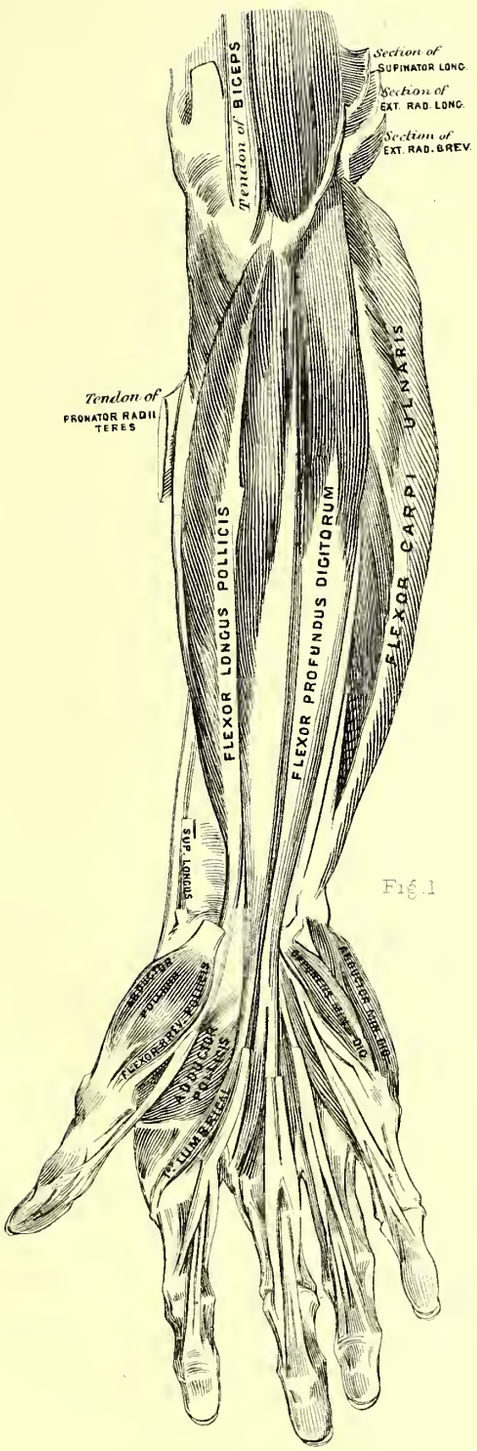


Fig. 1

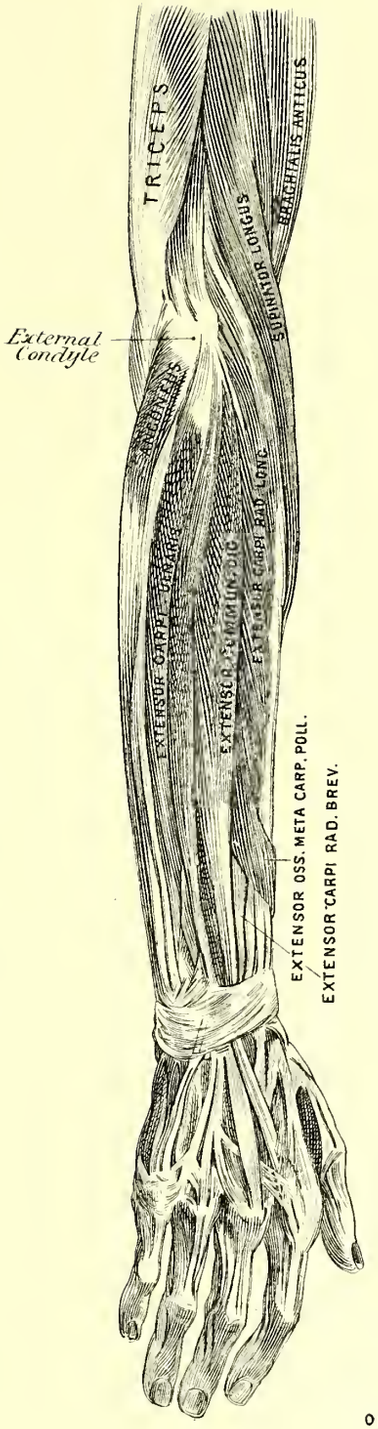


Fig 2

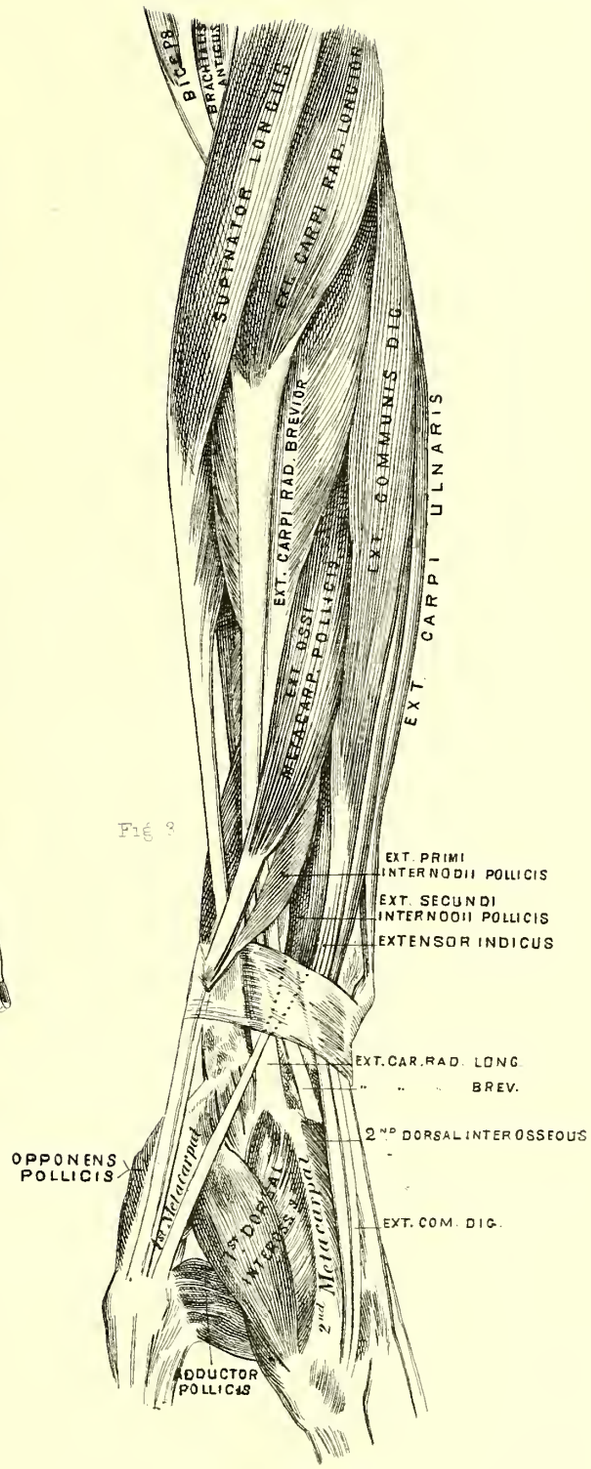


Fig 3

T. Sinclair & Son, Lith.

and partially underlies the scapular division of the Deltoid muscle. To the median side of the arm the anterior and posterior sheets are continuous over the sheath of the brachial artery and over the vein and the main nerve trunks. At the lower third of the arm the fascia is pierced by the basilic vein, by the internal cutaneous nerve, and by the cutaneous branch of the musculo-spiral nerve.

The External Intermuscular Septum extends from the epicondyle upward as far as the insertion of the Deltoid. It answers in position to the external supra-condyloid ridge, and separates the Brachialis Anticus, the Supinator Longus, and the Extensor Carpi Radialis Longior from the Triceps. The musculo-spiral nerve and superior profunda artery pass through it.

The Internal Intermuscular Septum extends from the base of the epitrochlea upward along the line of the supra-trochlear ridge as far as the insertion of the Coraco-Brachialis muscle. In front fibres of the Brachialis Anticus arise from it, and behind fibres of the Triceps. This septum differs from the external in having a conspicuous fibrous band which is continuous with the tendinous fibres of origin of the Coraco-Brachialis muscle, which pass to the inner side of the septum as far as the free end of the epitrochlea. This structure is called the *internal brachial ligament* by Struthers.[1] Behind the band near the elbow lies the ulnar nerve.

Fascia of the Forearm.—The fascia of the forearm is firmer below than above. It is strengthened near the elbow by oblique fibres, and passes to the sides from the fascia of the upper arm, and by the semilunar fascia from the tendon of insertion of the Biceps Flexor. It affords attachment to muscular fibres. Thus the Flexor Carpi Ulnaris in part, the Flexor Sublimis Digitorum, the Flexor Profundus Digitorum, the Extensor Carpi Radialis Brevior, and the Extensor Communis Digitorum, arise from this fascia. The fascia is free below the fibres of origin of these muscles. Posteriorly it may be said to be continuous with the fascia covering the Triceps and Anconeus muscles. Near the wrist it surrounds some of the tendons of the muscles, notably those of the Palmaris Longus in front, and of the radial extensor muscles. The radial artery and nerve are inclosed in a fascial membrane of loose texture; this is continued across the arm to the ulnar border. This membrane answers to the posterior layer of a sheath covering the Flexor Sublimis Digitorum.

The fascia of the forearm is much stouter than that of the arm. At the sides, and in front of the elbow it is stouter than behind. The fascia covers the forearm as a tight-fitting gauntlet, and is divided for convenience into three parts, viz.: (1), that over the Supinator Longus and the two Radial Carpal Extensors; (2), that originating over the epitrochlea and the muscles arising from it; and (3), that originating at and between the epicondyles and the olecranon.

(1) The fascia over the Supinator Longus and the two Radial Carpal Extensors is closely incorporated with the fibres of these muscles. Below it holds the tendon against the radius, and retains the tendons of the extensors of the thumb firmly in their oblique position. It ends laterally in the external intermuscular septum, and at the fascial slip overlying the Supinator Brevis.

(2) The fascia arising from the epitrochlea is continuous laterally with that over the Supinator Longus, and incloses the radial artery in the superficial portion of its course. It is held firmly to the Pronator Radii Teres and the Flexor Carpi Radialis muscles, while affording large surfaces of origin to them. To the ulnar side of the forearm it incloses the tendons of the Palmaris Longus and of the Flexor Carpi Ulnaris.

The fascia, after having been dissected from the radial to the ulnar border of the forearm along the line of these tendons, can be removed with ease from the Pronator Radii Teres and the Flexor Carpi Radialis muscles at their distal halves; but it is firmly united with them at their proximal halves. It cannot be raised from the tendons of the Palmaris Longus and of the Flexor Carpi Ulnaris; but the latter are raised with it, and the fascia inclosing them is found attached to the ulna at its radial posterior border, where it assists in the formation of an intermuscular septum. The fascia cannot be raised from the muscles between the epicondyle and the olecranon at the proximal third of the forearm.

(3) The fascia extending from the epicondyle to the olecranon, and thence down the dorsal aspect of the forearm, is in immediate connection with the Extensor Communis Digitorum and the Extensor Carpi Ulnaris. It cannot be raised at any point for any considerable distance without making an artificial dissection. A well-defined intermuscular septum dips down between the Extensor Communis Digitorum and the Extensor Carpi Ulnaris, and the entire division of fascia is firmly attached to the ulna for nearly its entire length.

The fascia of the forearm, as it passes to the hand, is called the *annular ligament*. The annular ligament

[1] Brit. and Foreign Med.-Chir. Rev., xiv. 1854, 225, note.

results, indeed, from the simple thickening of this fascia. It extends in the main from the anterior distal ends of the radius and the ulna, and protects, while affording a pulley-like band for, the muscles passing beneath it to the hands. It is strengthened by bands from the pisiform bone. In the undissected subject its position is indicated by a transverse fold in the skin.

Remarks.—Coulson[1] describes, in connection with the superficial fascia, a number of bursæ, as follows: a bursa in the axilla; one over the internal epicondyle, which has been known to assume the size of a walnut; one over the olecranon; one at the distal end of the radius; one at the distal end of the ulna; one at the carpus (this may often become enlarged, and contain about a drachm of fluid); a large bursa over the first joint of the thumb; other bursæ, often double, over the first and second joints of the fingers.

The annular ligament, in its practical relations, is perhaps the most important portion of the fascia of the forearm. When the sheaths of the flexors are distended by an excess of fluid, it divides the swelling into two parts, since it is too rigid to yield to pressure.[2] Symes[3] recommends its division in distension of the sheaths of the fingers. According to Sir Charles Bell,[4] the fascia in inflammatory states of the arm acts as a bandage, and constricts the parts beneath without itself becoming either inflamed or contracted. In marked examples the forearm may be flexed on the arm, and the fingers may be flexed. Free incisions of the fascia are recommended to relieve the tension.—Nelaton[5] describes a condition of deep-seated suppuration in the forearm in which the pus appears to originate about the tendon of the Flexor Longus Pollicis, the sheath of which participates in the disease, and thence passes to the front of the interosseous ligament and the Pronator Quadratus. He recommends that an incision be made laterally: viz., near the radial margin of the forearm, using the tendon of the Flexor Carpi Radialis as a guide, and thence boldly pushing down through the Flexor Profundus.

The Palmar Fascia.—Under the name of the Palmar Fascia is embraced the delicate aponeurosis lying beneath the skin of the palm. Its longitudinal fibres are in continuity with the tendon of the Palmaris Longus and receives accessions from the fascial layer of the annular ligament about the wrist. It gives shape to the body of the hand, assists in the formation of the web of the fingers, provides slips extending to the metacarpal bones, and aids in the formation of sheaths for the Lumbricales and Interossei muscles.[1]

The bands assisting to form the web of the fingers are known as the "fibres of Gerdy." These are the most conspicuous of the transverse fibres of the fascia. They are specially well developed at the distal border, where they so unite the first row of phalanges as to interfere with the complete separate flexion of any one finger.

[1] Lond. Med. Journ., 1851.

[2] Coulson, Lond. Med. Journ., 1851.

[3] Edinburgh Monthly Journ., Oct. 1844.

[4] Surgery, i. 67.

[5] N. Y. Med. Journ., April, 1866 (from vol. iii. Journ. of Prac. Med. and Surg.).

[1] In the course of an elaborate study of the palmar fascia in connection with "Dupuytren's Finger Contraction," my friend Dr. W. W. Keen has called attention to this feature. Arching over from one metacarpal bone to the other are three strong fibrous bands, posterior to which lie the Interosseous muscles.—From the under surface of the fascia, as it reaches the level of the knuckles, eight or nine more or less well-marked partitions arise and pass posteriorly to be attached as follows: four of them reach the metacarpals, blending with the arching fibrous bands just described; the others are attached directly to these bands at points between their bony attachments. These partitions or pillars form seven distinct canals. Through four of these pass the flexor tendons of each finger in pairs. Through the other three pass the three ulnar Lumbricales, and with them the interosseous artery and the digital nerves. The radial or first Lumbrical muscle is sometimes included in a separate canal, more often it is not. These canals secure the flexor tendons in the palm.

EXPLANATION OF PLATE XLIX.

Fig. 1. The muscles of the palmar surface of the hand.

Fig. 2. The interossei muscles, seen from the palmar surface.

Fig. 3. The interossei muscles, seen from the dorsal surface.

PLATE XLIX

Fig 1

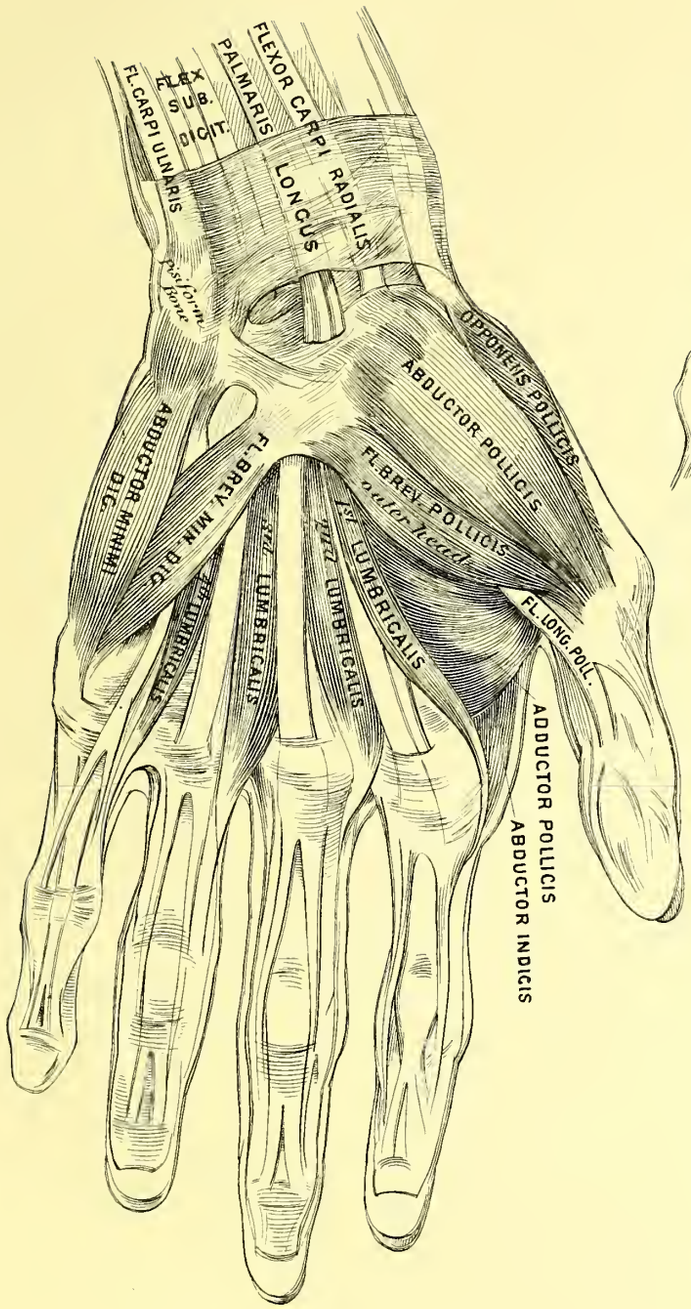


Fig 2

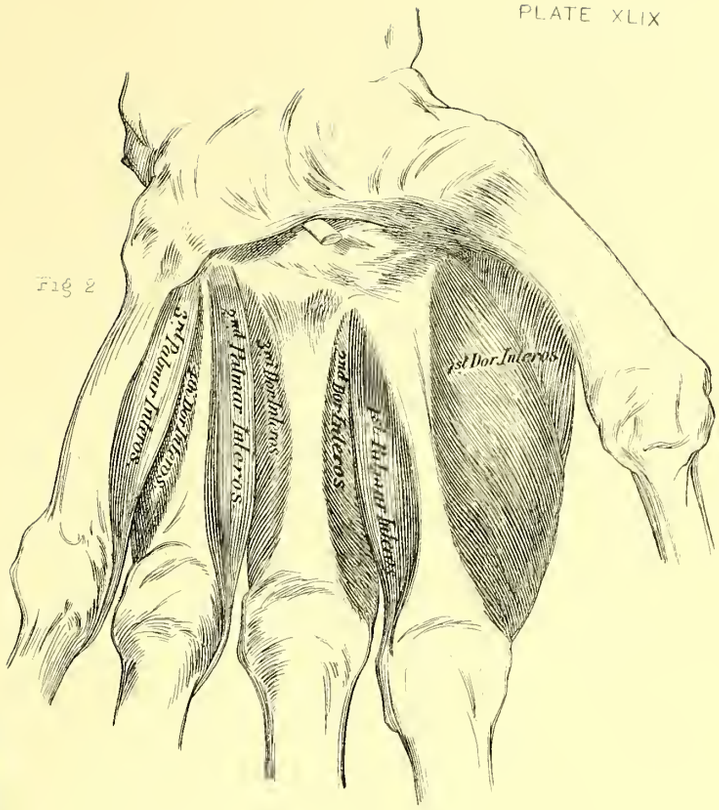
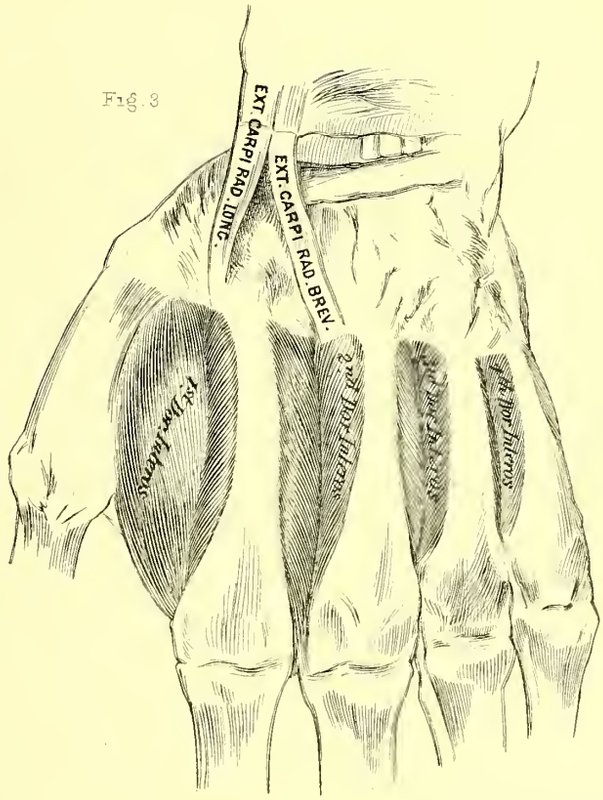


Fig 3



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V. THE MUSCLES OF THE INFERIOR EXTREMITY.

The Muscles of the Hip.

The muscles of the hip include—

The Gluteus Maximus.
The Gluteus Medius.
The Gluteus Minimus.
The Pyriformis.
The Obturator Internus.
The Obturator Externus.
The Quadratus Femoris.

THE GLUTEUS MAXIMUS.

The Gluteus Maximus is the coarsest muscle in the body. It is a broad fasciculated mass giving prominence to the buttock.

It arises from the posterior fifth of the outer lip of the crest of the ilium, from the posterior surface of the lumbo-sacral aponeurosis, from the lateral border of the sacrum and coccyx, and from the sacro-iliac ligament along its entire extent. The fibres pass downward and outward, forming a quadrilateral mass thicker at the centre than at the borders. The muscle is inserted into the femur at a part answering to the expanded outer lip of the produced linea aspera, as well as into the fascia lata, from a point near the base of the great trochanter to one near the middle of the thigh.

The muscle is fleshy throughout the greater part of its course. The thick aponeurosis arising from the anterior portion of the crest of the ilium is continuous with the Gluteus Maximus at its upper and anterior border and may be said to constitute part of it as well as part of the Gluteus Medius, with which muscle it is described.

The fibres arise by two concentric lines, the superficial and the deep; the *superficial* form an arched line extending from the lumbo-sacral fascia to the sacral cornu; the *deep*, from the outer border of the sacrum and the great sacro-sciatic ligament. — The insertion of the muscle may be minutely described as follows: The upper fibres are parallel with a thick fibrous lamina which passes over the great trochanter. They are inserted on a duplication of the fascia lata, as well as on the femur. The inferior fibres have a large but short tendon, which is continuous above with the preceding lamina, and with the aponeurosis of the external portion of the Quadriceps Extensor. They are attached to the outer lip of the linea aspera and to the parts above this line.—The majority of the fibres are inserted into the fascia lata; the lower part only is tendinous, and is inserted into the femur at the height of the lesser trochanter at the line of the upper outer limb of the linea aspera.

Between the tendon and the lower part of the great trochanter and extending thence a short distance along the Vastus Externus, a large bursa is seen. A second bursa, lying between the muscle at the great trochanter and the skin, may suppurate and simulate hip-joint disease.[1]

Relations.—Above to the inner and outer side lie the skin and a thin translucent fascia. Below lie the Gluteus Medius, Pyriformis, and Quadratus Femoris muscles, the tendon of the Obturator Internus, the Gemelli, the superficial branch of the gluteal artery, the greater and lesser sciatic nerves, the great trochanter, the tuberosity of the ischium, and the pelvic origin of the hamstring muscles. Also beneath the muscle, and lying in the space between the great trochanter and the tuberosity of the ischium, are the inferior gluteal vessels.—The muscle forms in part the outer border of the ischio-rectal fossa.

The lower border is the inferior boundary of the nates. It is tense when the muscle is contracted. Hence the value of this line in detecting painful conditions of the hip-joint, especially coxalgia in its first stage. The patient will not place any weight upon the affected thigh, the fascia lata and Gluteus Maximus are relaxed, and the "fold of the buttock" sags downward.

The fibres of the Gluteus Maximus are divided in operations upon the gluteal artery. Lizar's line is drawn from the posterior superior spinous process of the ilium downward between the tuberosity of the ischium and the great trochanter.

Use.—The Gluteus Maximus forcibly extends the thigh upon the pelvis. When the anterior fibres of the muscle act alone the femur is rotated inward. It is probable that when the posterior fibres act alone the bone is rotated outward.

According to Duchenne, it is not so efficient in preserving the erect position or in the act of walking as has been generally supposed. The muscle aids in certain motions of the limbs, such as are made in ascending stairs, in leaping, in dancing, and in rising from a sitting posture. When the muscle is atrophied, the extending force of the limb is impaired, notably when weights are borne upon the shoulders.

Nerve.—The muscle is supplied by the superior and inferior gluteal nerves.

Variations.—A tendency exists for Longitudinal cleavage to take place between the coccygeal and sacral fascicles. The former are then homologous with the Agitator Caudæ of many quadrupeds. Slips may arise from the lumbar aponeurosis, the sacro-sciatic ligament, and the ischial tuberosity.

[1] T. G. Teale, Lancet, Oct. 1870, p. 506.

THE GLUTEUS MEDIUS.

The Gluteus Medius muscle arises fleshy from the anterior three-fourths of the external lip of the crest of the ilium, from the space upon the dorsum of the ilium between the superior and middle semicircular lines, from a tendinous arch—stretching from the outer border of the sacrum to the upper border of the great sciatic notch—and from the fascia lata. The anterior border is more or less united with that of the Gluteus Minimus, as the two layers of the Masseter are united at the anterior border of that muscle. The fibres of the Gluteus Medius converge from the point of origin; the posterior group, being the more oblique, passes downward and forward to be inserted tendinously into the outer aspect of the great trochanter throughout its extent.

A small bursa lies between the tendon and the Pyriformis muscle, and another between the muscle and the great trochanter.

W. Macewen[1] notes a case in which this bursa became enormously distended and was opened by a surgeon. A second time it spontaneously discharged, and was finally permanently healed by free incision, the use of stimulating injections, and rest.

Use.—The posterior fibres aid in rotating the thigh outward, and the anterior fibres in rotating it inward (see account at end of Gluteus Minimus).

Nerve.—The muscle is supplied by both the superior and the inferior branches of the superior gluteal nerve.

The muscle secures an attachment from the anterior superior spinous process of the ilium, and from the depression beneath it. A fibrous line, more or less pronounced (sometimes being a tendon which divides the muscle), lies in the middle of the mass, and separates the posterior from the anterior fibres. The muscle is radiated, with a concealed tendon.

Relations.—In front lie the Gluteus Maximus and the fascia lata in part; behind lie the Gluteus Minimus, the dorsum of the ilium, and the superior gluteal vessels and nerves. Anteriorly it is continuous with the Gluteus Minimus and with the Tensor Vaginæ Femoris. When the femur is rotated outward the lower fibres of the tendon overlie the Vastus Externus.

Variations.—The fusion with the Gluteus Minimus at its anterior border is subject to variation. Posteriorly the muscle may fuse with the Pyriformis.

[1] Glasgow Medical Journal, 1876, 477.

THE GLUTEUS MINIMUS.

The Gluteus Minimus muscle arises from the dorsum of the ilium between the superior and the inferior curved line. It also arises from a small portion of the crest anteriorly, and from the anterior border of the great sciatic notch. Its fibres are in part continuous with the corresponding border of the Gluteus Medius. The fascicles converge to form a narrow tendon, which is inserted on the anterior border of the great trochanter. Beneath it lies a small bursa.[1] A shining aponeurosis is extended on the outer surface of the muscle.

Relations.—Above lie the Gluteus Medius and the deep gluteal artery. Below are the innominate bone, the posterior portion of the capsule of the hip-joint, the acetabular head of the Rectus Femoris in part, and the origin of the Vastus Externus. In front lies the Tensor Vaginæ Femoris.

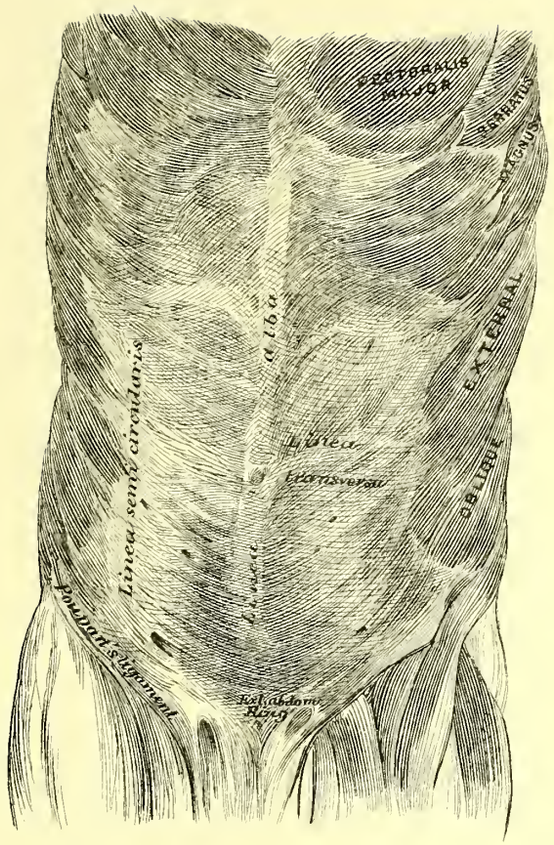
Use.—Action upon insertion: The muscle is composed functionally of two fascieuli having different lines of action. The anterior part carries the limb obliquely forward and inward. The posterior portion initiates a movement of rotation from within outward. —Action upon origin: Together with the Gluteus Minimus the Gluteus Medius fixes the pelvis upon the thigh both during rest in the erect position and in the second stage of the act of walking. This fact is proved clinically, since in paralysis of the Gluteus Medius and the Gluteus Minimus the pelvis is inclined to the opposite side at the moment when the body rests upon the affected limb, notwithstanding that the Gluteus Maximus is in a healthy condition.

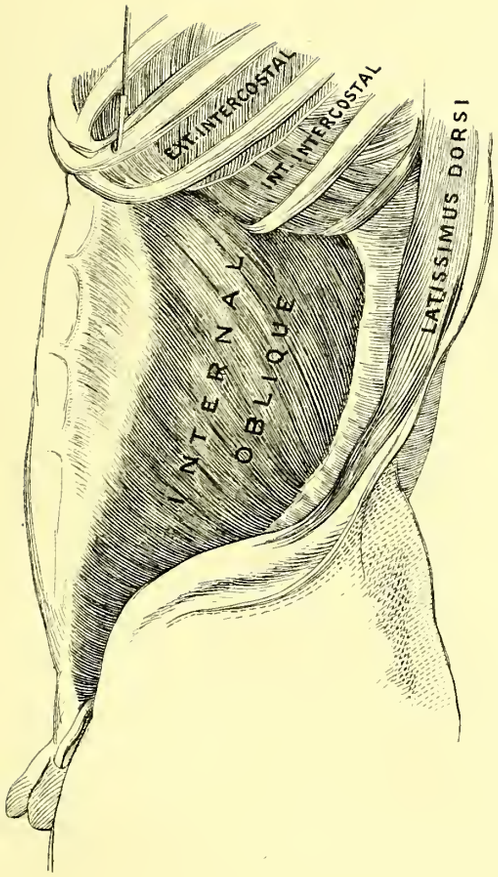
Nerve.—Supplied by the superior and inferior branches of the superior gluteal nerve.

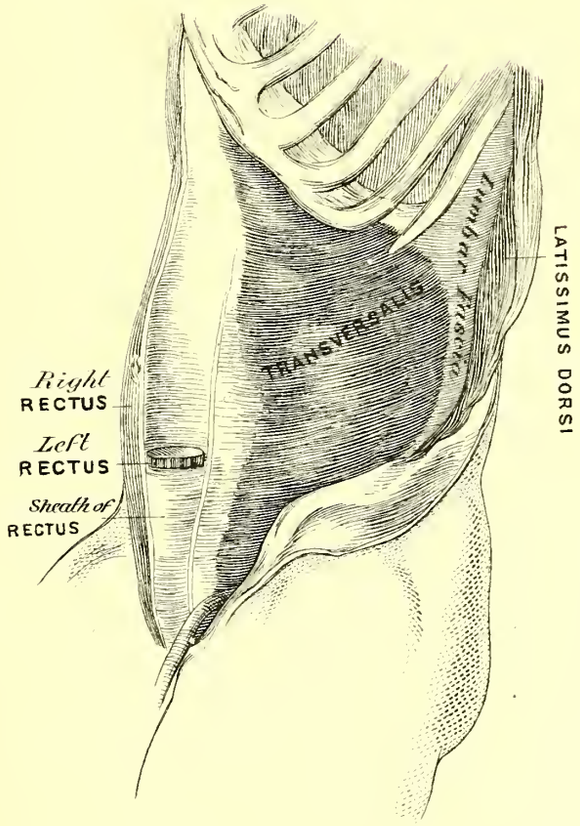
[1] H. Meyer (Zeit. für Anatomie und Entwickelungsgeschichte, 1876, 29) describes the Gluteus Minimus muscle as the type of the gluteals to which the Gluteus Medius and Gluteus Maximus stand in the relation of planal repetitions (Verdoppelungs muskeln).

EXPLANATION OF PLATE L.

Fig. 1. The superficial muscles of the abdomen.
Fig. 2. The internal oblique muscle of the abdomen.
Fig. 3. The transversalis muscle of the abdomen.


PECTORALIS MAJOR
SERRATUS
EXTERNAL OBLIQUE
Linea semicircularis
Linea alba
Linea transversa
Poupart's ligament
External Ring


EXT. INTERCOSTAL
INT. INTERCOSTAL
INTERNAL OBLIQUE
LATISSIMUS DORSI


Lumbar Fascia
TRANSVERSALIS
LATISSIMUS DORSI
Right RECTUS
Left RECTUS
Sheath of RECTUS

Variations.—The anterior portion of the muscle may be partially or entirely distinct from the rest of the muscle forming the slip—constant in some of the man-like apes, and occasionally seen in the coati—known as the Scansorius. This slip, or head as some writers denominate it, may be intimately associated with the Sartorius and the Tensor Vaginæ Femoris.—The muscle may be in close union with the capsule of the hip-joint. Its insertion into the trochanter may be strengthened by a slip from the ilio-femoral fascicle of the capsule.—A slip may pass from the muscle to the fascia lata.

The following table may serve a useful purpose in correlating the functionally separated portions of the gluteal muscles with other anatomical facts.

Anterior portions of Gluteus Medius, Gluteus Minimus (scansorial fibres), Tensor Vaginæ Femoris,	Rotate the thigh inward, in which act they are assisted by the anterior fibres of the Gluteus Maximus. Tend to fuse with one another. Arise from the innominate bone from the first concavity of the dorsum (see p. 186) by nearly vertical fibres, and are in close association with the fascia lata.
Posterior portions of Gluteus Medius, Gluteus Minimus,	Rotate the thigh outward, in which act they are assisted by the posterior fibres of the Gluteus Maximus, Pyriformis, Obturator Internus, Obturator Externus, Quadratus Femoris, and Adductor Muscles. Tend to fuse with the Pyriformis, and with the posterior fibres of the Gluteus Maximus. Arise from the innominate bone by oblique fibres beyond (*i. e.*, posterior to) the first concavity, and are nearly free from the fascia lata.

THE PYRIFORMIS.

The Pyriformis muscle arises from the antero-lateral surface of the sacrum at the intervals between the grooves of the second and the fourth sacral foramina, from the ilium at the great sciatic notch, and near the sacro-iliac junction, and from the great sacro-sciatic ligament. The muscle passes nearly horizontally outward through the great sacro-sciatic foramen, and is inserted into the femur at the upper border of the great trochanter. It is here in close connection with the tendon of the Obturator Internus.

Use.—Besides rotating the femur outward, it at the same time induces an oblique movement backward and a little outward, after the manner of the most posterior of the fibres of the Gluteus Medius and the Gluteus Minimus muscles.

Nerve.—It is supplied by a branch of the sacral plexus.

Relations.—In front lie the rectum, the sacral plexus of nerves, and the internal iliac vessels as the muscle lies within the pelvis, and the capsule of the hip-joint without. Behind lie the sacrum and the innominate bone. Above it lies the Gluteus Medius, and below it the Obturator Internus. The Gluteal vessels and nerves lie at its upper border.

The central tendon is composed of thin pearly fibres beneath. It is more or less continuous with the capsule of the hip-joint. The muscle may be considered to be an imperfectly differentiated slip of the Gluteus Medius.

Variations.—The muscle is sometimes double, allowing the great sciatic nerve to escape between the two bellies. It may fuse with the Gluteus Medius, with the Coccygeus above, and with the Obturator Internus below. It may be inserted into the capsule of the hip-joint.

F. S. Eve[1] found this muscle and the Gemelli ruptured in dislocation of the head of the femur backward.

[1] Med. Chir. Trans., lxii., 51.

THE OBTURATOR INTERNUS.

This muscle arises from the narrow strip of bone to the inner side of the obturator foramen, from the posterior surface of the obturator ligament, and from the bone as far back as the sciatic notch. It also arises from the tendinous arch which converts the sub-pubic (obturator) groove into a canal, and from the obturator fascia. It passes through the lesser sacro-ischiatic foramen, its tendon winding around the trochlear surface on the ischium, and is inserted into the femur at the bottom of the digital fossa. As it escapes from the pelvis the muscle receives a pair of accessory slips known as the Gemelli muscles.

The Superior Gemellus arises from the spine of the ischium; the Inferior Gemellus from the tuberosity, and in part from the great sacro-sciatic ligament. The two slips converge and form a groove-like inclosure for the tendon of the Obturator Internus, a short distance from its termination.

A bursa exists beneath the tendon at its point of reflection over the ischium. The tendon here is often marked by several minute longitudinal streaks. A second small bursa lies between the tendon and the fibrous capsule of the joint.

Variations.—Accessory slips of origin from within the pelvis below the ilio-pectineal line, and the parts about the margin of the inferior pelvic strait. Infrequently a slip may arise from the third sacral vertebra.—The Superior Gemellus may be absent, or be fused with the Obturator Internus. It may be distinct and inserted in the capsule of the hip-joint, or be fused either with the Pyriformis or the Gluteus Minimus. —The Inferior Gemellus may be absent, fused with, or compensatory with the Quadratus Femoris.

Use.—To rotate the femur outward, in which action it is aided by the Quadratus Femoris and the Obturator Externus. Under traction from the mus-

cles named the femur tends constantly to moderate rotation outward. Inversion is usually the result of impaired power in one or more muscles of the group.

The action of the Obturator Internus is antagonized by the anterior fibres of the Gluteus Medius and Gluteus Minimus muscles.

Nerve.—The Obturator Internus is supplied by a separate branch of the sacral plexus.

Relations.—Above the muscle lie the Gluteus Maximus, the great sciatic nerve, and the vessels escaping from the lesser sacro sciatic foramen. Beneath are a portion of the ischial tuberosity, the upper border of the Quadratus Femoris, and a large bursa. The muscle is tendinous in the interior. The tendon is broad, but more or less plicated.

Remarks.—H. J. Bigelow[1] finds that dislocation of the head of the femur upward and backward, "below the internal obturator tendon and the subjacent capsule," is "probably common, as the neck of the femur is here first arrested in its ascent from the frequent downward displacement which occurs while the limb is flexed, as it is in the great majority of such accidents." He proposes to call such displacements *luxations below the tendon* to distinguish them from *luxations above the tendon*. F. S. Eve[2] found the muscle ruptured in dislocation of the head of the femur upward and backward. He also found the Gemelli and Pyriformis muscles ruptured in dislocation of the head of the femur backward.[3]

THE OBTURATOR EXTERNUS.

The Obturator Externus muscle arises from the upper and the inner border of the obturator foramen and the corresponding portion of the obturator membrane, and from the transverse fibres which extend from the obturator membrane to the capsule of the hip-joint. The fibres converge to form a stout belly, which turns round the neck of the femur to be inserted by a stout rounded tendon into the femur at the posterior edge of the digital fossa, below the tendon of the Obturator Internus.

Use.—To roll the femur outward, and to support the head of the femur in the erect position.

Nerve.—The muscle is supplied by the obturator nerve.

In a case of long standing hip-disease, recorded by Mr. Hulke,[1] pus found its way into the pelvis, whence it was guided by the tendon of this muscle to the obturator membrane, piercing which it was conducted to the exterior of the pelvis. Dense fascia excluded this collection from the pelvic cavity.

Variations.—Slips may pass from this muscle to the Adductor Brevis. Unimportant fascicles arising from the walls of the true pelvis may contribute to the body of the muscle.

The fact that the muscle may contribute to the composition of an Adductor muscle, and that it is supplied by the same nerve as the Adductor group, places the Obturator Externus in close relationship to the Adductors.

THE QUADRATUS FEMORIS.

The Quadratus Femoris arises from the lateral border of the tuberosity of the ischium, and passes horizontally outward to be inserted on the femur at a vertical line (*linea quadrati*) extending downward from the centre of the intertrochanteric line toward the linea aspera.

Use.—To adduct the femur. From its tendency to fusion with the Gemellus Inferior it is probable that this muscle may assist in rotating the femur inward, and thus aid the muscles inserted into the digital fossa, while feebly antagonizing the muscular fibres supplied by the inferior gluteal nerve.

The fibres are short and interspersed with fibrous tissue or fat.

Nerve.—The muscle is supplied by a long and delicate branch from the sacral plexus.

[1] The Hip, p. 37. [2] Med.-Chir. Trans., lxii. 51.
[3] Ibid.

[1] Trans. Path. Soc. Lond., 1863, xiv. 213.

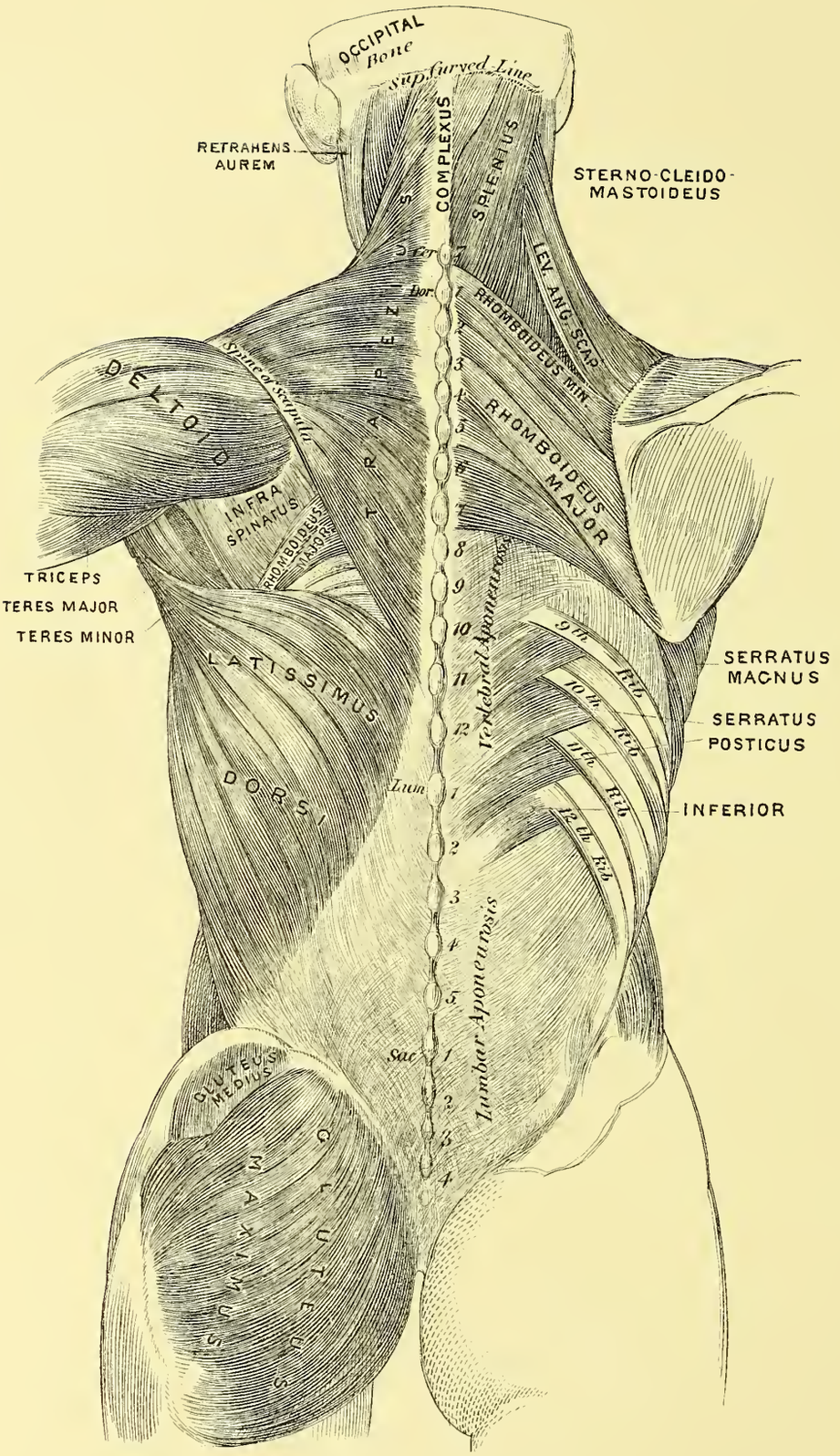
EXPLANATION OF PLATE LI.

Fig. 1. The muscles of the back including the extrinsic muscles of the superior extremity.

EXPLANATION OF PLATE LII.

Fig 1. The deep muscles of the nape of the neck.

Fig. 2. The diaphragm, seen from beneath.


OCCIPITAL
Bone
Sup. Curved Line
RETRAHENS AURUM
COMPLEXUS
SPLENIUS
STERNO-CLEIDO-MASTOIDEUS
LEV. ANG. SCAP.
RHOMBOIDEUS MIN.
RHOMBOIDEUS MAJOR
DELTOID
Spine of Scapula
INFRA SPINATUS
RHOMBOIDEUS MAJOR
TRICEPS
TERES MAJOR
TERES MINOR
LATISSIMUS DORSI
Vertebral Aponeurosis
9th Rib
10th Rib
11th Rib
12th Rib
SERRATUS MAGNUS
SERRATUS POSTICUS INFERIOR
Lumbar Aponeurosis
GLUTEUS MEDIUS
GLUTEUS MAXIMUS

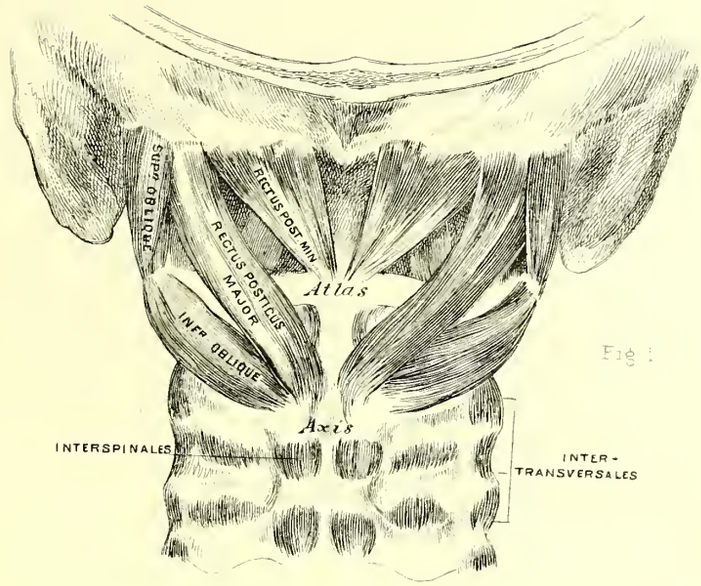


Fig 1

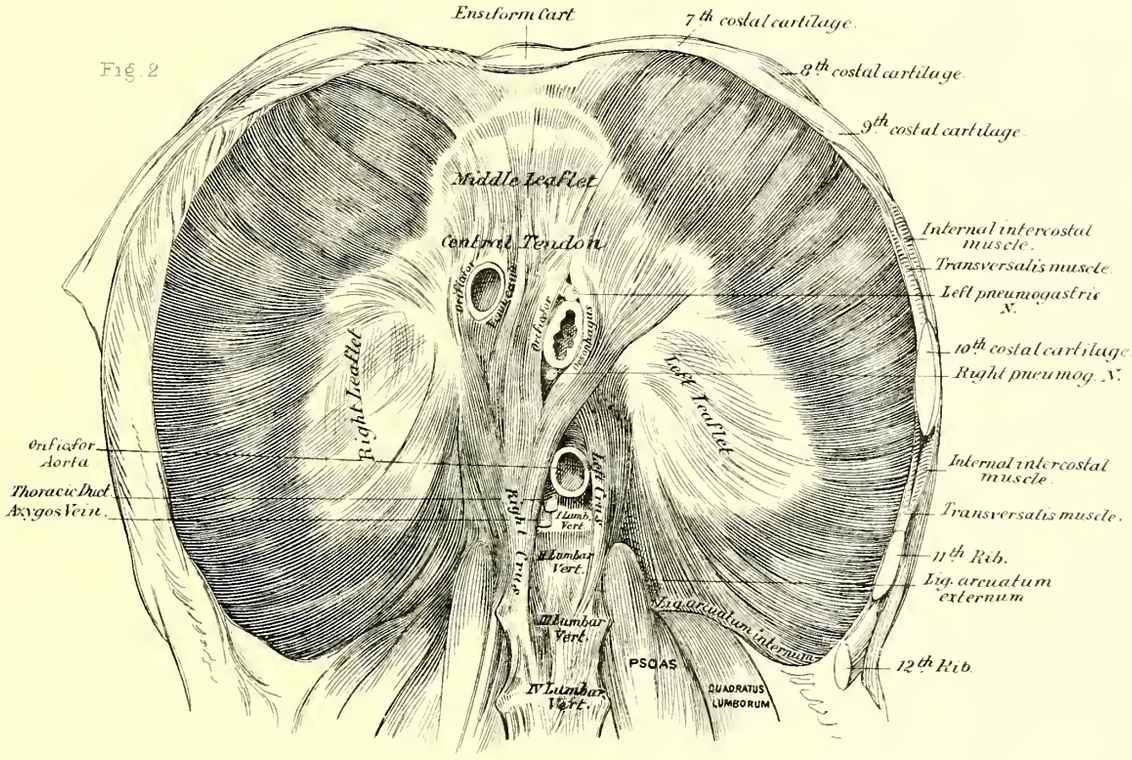


Fig 2

T. Sinclair & Son, Lith.

Variations.—It may be absent, when the Gemellus Inferior may take its place.—It may fuse with the Adductor Magnus, the Obturator Externus, and the Semimembranosus. Its insertion is apt to be divided into a number of separate fascicles.—It may send a fascicle to the great bursa beneath the Gluteus Maximus.—A bursa may lie beneath the muscle at the trochanter minor.

Relations.—The Quadratus Femoris is a member of the adductor group of muscles. It is separated from the Adductor Magnus by the internal circumflex vessels, and from the Semimembranosus behind by a quantity of adipose tissue. Above, it is crossed by the origin of the posterior femoral group of muscles, by the great sciatic nerve, and in part by the Gluteus Maximus muscle; behind by the Obturator Internus.

The Posterior Femoral or Hamstring Muscles.

The muscles of this group include—

The Biceps Flexor Cruris.
The Semitendinosus.
The Semimembranosus.

THE BICEPS FLEXOR CRURIS.

The Biceps muscle (external hamstring), as is implied by the name, possesses two heads—an ischiatic and a femoral. The ischiatic head arises tendinously from the tuberosity of the ischium in conjunction with the Semitendinosus; and for a short distance below the place of origin the two muscles are conjoined. The femoral or shorter head arises by fleshy fibres from the lower two-thirds of the linea aspera and the posterior surface of the sheath of the Vastus Externus (external intermuscular septum). This head forms a ribbon-shaped bundle, and joins the long head at its anterior surface to form the body of the muscle a short distance above the formation of the tendon of insertion. The muscle is inserted into the head of the fibula, and usually sends fibrous expansions to the external femoral condyle, to the fascia of the leg, and to the head of the tibia.

Near the insertion the muscle is aponeurotic on the superficial, and fleshy on the deep, surface. Near the origin it is fleshy on the superficial, and aponeurotic on the deep, surface. With care a dissection can be made showing the continuity of the origin of the Biceps with the great sacro-sciatic ligament.

Use.—To flex the leg on the thigh, and, to a slight degree, to extend the thigh on the pelvis. It usually acts with the Semitendinosus, which passes to the median side of the proximal end of the tibia, the Biceps passing to the corresponding end of the fibula. The two muscles pull the leg backward somewhat after the manner in which the reins held in the hand of the driver can pull back the head of a horse. When the muscle acts alone, it produces external rotation of the leg.—The tendon of insertion supports the capsule of the knee-joint laterally. To a slight degree it makes tense the fascia of the leg, and prepares the Peroneal muscles for action.

Undue or unantagonized action of the Biceps is seen in some of the forms of "knock-knee." It induces outward rotation of the leg, and accompanies some varieties of paralysis of the femoral inward rotators. This action of the Biceps connects the muscle functionally with the Gluteus Maximus (see fascia of lower extremity).

Nerve.—The muscle is supplied by branches from the great sciatic.

Relations.—In front lies the sciatic nerve, which follows this muscle more closely than it does the other hamstrings and the Adductor Magnus. The Gluteus Maximus covers in the origin. It aids in defining the popliteal space externally. The tendon of insertion is a guide to the external popliteal nerve which lies to the median side.—The muscle is exceptionally vascular.

The origin of the Semitendinosus lies behind that of the Biceps.—The superficial lamina of the Semitendinosus alone fuses with the Biceps.—A slip of the tendon lies behind the long external lateral ligament.—The tendon of insertion is attached to the fibula at the middle of the styloid process.—A bursa lies between the tendon and the capsule of the knee-joint. Enlarged conditions of this bursa have been detected in the living subject.[1]

Variations.—The femoral head of the Biceps may be absent. A second long head may arise from the tuberosity of the ischium. A third femoral head may arise from near the proximal end of the linea aspera. It may receive a fascicle from the Gluteus Maximus. It may arise in part from the great sacro-sciatic ligament and the sacral vertebræ. It may join the Gastrocnemius near the tendo Achillis, or a pelvic slip may reach the fascia of the leg. A slip may pass to the knee-joint and to the long external lateral ligament. The tendon of insertion, in part, is almost always continuous with the Peroneus Longus.

THE SEMITENDINOSUS.

This muscle arises from the tuberosity of the ischium, and from the tendon of the Biceps Flexor for about three inches. It forms a fusiform belly, which passes downward and inward to form a slender rounded tendon at about the middle of the thigh; and is inserted into the outer condyle of the femur, the

[1] W. Macewen, Glasgow Med. Journ. 1876, 469.

tubercle of the tibia, and by an aponeurotic slip into the fascia of the leg.

The muscle exhibits a tendinous inscription at about its middle.—A bursa is seen between the tendons of the Semimembranosus and the Semitendinosus.—The muscle is bilaminate for a short distance from its origin, the space between the laminæ receiving bloodvessels. The superficial lamina fuses with the Biceps; the deep lamina furnishes a small surface of origin for some of the fibres of the Semimembranosus.—The tendons of the Semitendinosus and the Gracilis pass through a loop at the upper and inner part of the deep fascia of the calf, and are thence inserted beneath the aponeurosis of the Sartorius. It may be said that the deep fascia of the leg is made tense by a pulley-like action on the part of the two muscles in question, as well as by the Sartorius.

Use.—To flex the leg on the thigh, and to rotate it inward.—In paralysis of this muscle (commonly associated with paralysis of the Biceps) the trunk has a tendency (the body being erect) to fall forward. The muscle, assisted by the Gracilis and Sartorius, makes the fascia of the leg tense.

Nerve.—This is derived from the great sciatic.

Relations.—In front are the Adductor Magnus, a few small bloodvessels intervening, and the tendon of the Semimembranosus in part. To the inner side, in front, lies the Semimembranosus. To the outer side lies the Biceps Femoris. The muscle assists in limiting the popliteal space medianly. It is singularly free from variation.

THE SEMIMEMBRANOSUS.

The Semimembranosus muscle arises, by a stout tendon, from the tuberosity of the ischium in front of the conjoined tendon of the Biceps and the Semitendinosus. The long tendon passes thence downward and inward to end abruptly in a large fleshy mass at the lower third or half of the thigh. This mass, the belly of the muscle, presents a rounded outer border, and is for the most part inserted into the inner tuberosity of the tibia. A careful examination of the tendon of insertion shows that it is composed of three portions, as follows: First, a large slip of fibres, passing inward and upward to the outer condyle of the femur, constitutes the posterior oblique ligament of the knee-joint; it aids in strengthening the ligament of Winslow. Second, a bundle of nearly vertical fibres answering to the main mass of the muscle is inserted into the internal tuberosity. Third, a set which is inserted into the inferior margin of the articular surface of the tibia.

This muscle and the Semitendinosus form the internal hamstrings.

A bursa exists beneath the origin of the Semimembranosus; and a second between the tendon of the muscle and the tibia.

W. Macewen[1] describes a bursa common to the Semimembranosus and the internal head of the Gastrocnemius.

Use.—The Semimembranosus flexes the leg on the thigh, and aids in extending the thigh on the pelvis. It aids in rotating the leg, and, in connection with the Biceps, the thigh also.

Nerve.—This is derived from the great sciatic.

Fergusson[2] describes an instance of a popliteal aneurism bursting, the blood entering the bursa lying beneath the Semimembranosus, and thence entering the knee-joint.—Bryant[3] mentions the rupture of this muscle near its origin in a man of sixty-five years. The rupture was caused by an attempt to lift a heavy weight while the body was bent forward.

Variations.—The muscle may be absent. It resembles the Biceps in a disposition to increased proximal origin, notably from the great sacro-sciatic ligament.—The three hamstrings may fuse at their origin, leaving a bursa within a cylinder-like fibrous tendon.

Relations.—The tendon of origin lies in front of the common origin of the Biceps and the Semitendinosus, and behind the Quadratus Femoris in part, and the Adductor Magnus. At the lower third of the thigh, it lies behind the Gracilis. With the Semitendinosus it aids in defining the inner border of the popliteal space.

A broad fascia extends from the median border of the tendon of the Semimembranosus, as it crosses the knee-joint; it lies beneath the deep fascia, and is lost over the Gastrocnemius muscle.

[1] Glasgow Med. Journ. 1876, 469.
[2] Trans. Path. Soc. Lond., ix. 122.
[3] Surgery, 899.

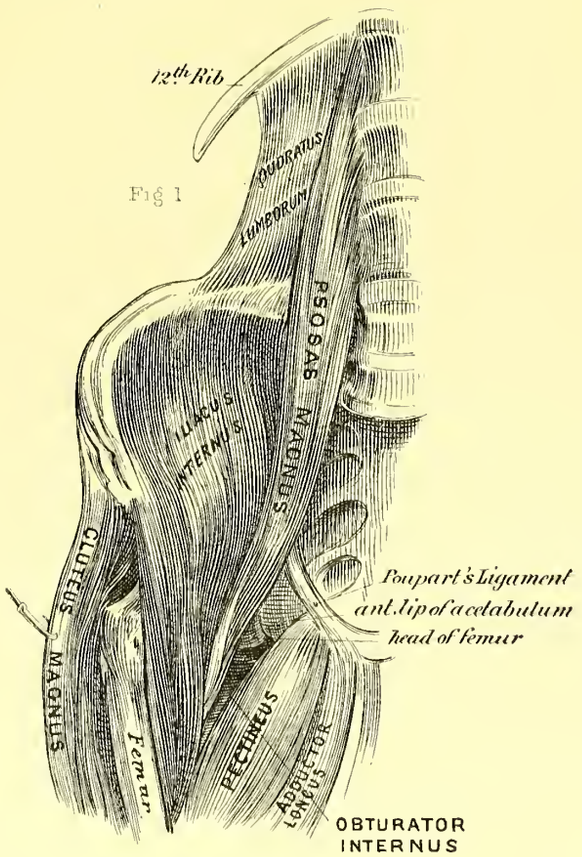
EXPLANATION OF PLATE LIII.

Fig. 1. The muscles of the groin and anterior aspect of the loin.

Fig. 2. Frontal section of a portion of the wall of the thorax, showing the position of the intercostal muscles.

Fig. 3. The deep muscles of the buttock.

Fig 1



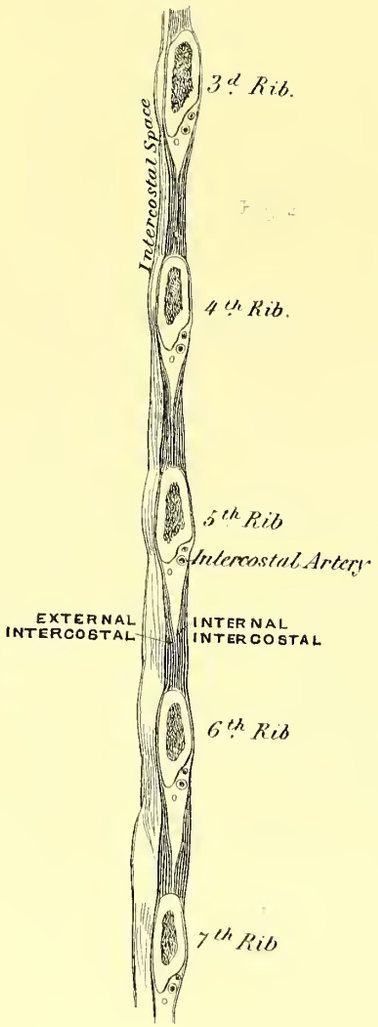


Fig 3

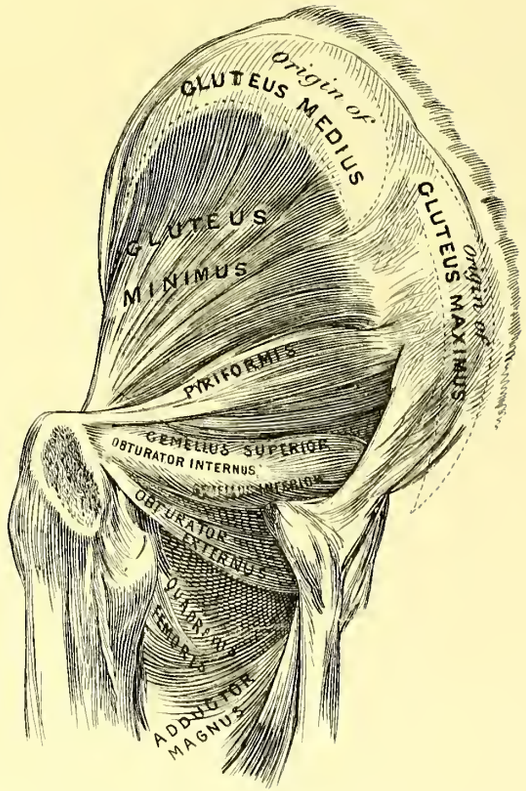


PLATE LIII

The Anterior Muscles of the Thigh.

The anterior muscles of the thigh are—
The Psoas Magnus.
The Iliacus Internus.
The Sartorius.
The Tensor Vaginæ Femoris.
The Quadriceps Extensor Cruris.

THE PSOAS MAGNUS.

The Psoas muscle arises from the border and the transverse process of the last dorsal and the first four of the lumbar vertebræ, and from the intervertebral tissues. The muscle possesses a soft fleshy belly broader behind than in front, and forms at the sacro-iliac junction a conspicuous tendon which passes beneath Poupart's ligament to be inserted into the femur at the trochanter minor. The tendon is joined laterally just before its insertion by the fibres of the Iliacus Internus muscle.

The muscle arises from tendinous arches at the side of the bodies of the vertebræ rather than from the bones themselves, and may secure additional origin by minute slips from the costo-transverse ligaments.—The fascicles from the transverse processes are more pronounced above than below.

A distinct accessory bundle, known as the Psoas Parvus, arises from the transverse processes of the upper lumbar vertebræ, and is inserted by a distinct tendon into the tendon of the main muscle. It is often absent.

Another slip, named the Psoas Minor, arises from the transverse processes of the last dorsal and the first lumbar vertebræ, passes along the inner border of the main muscle, and is lost in the iliac fascia at the border of the true pelvis.

Use.—To flex the femur upon the pelvis. The muscle cannot produce this movement without turning the femur from within slightly outward. When acting with the anterior portion of the two smaller Glutei muscles, it swings the limb not merely forward, but slightly outward.

Nerves.—These are derived from the third lumbar nerve.

Variations.—The Psoas and the Iliacus Internus may be distinct throughout. The Psoas may arise from all the lumbar vertebræ. This origin is given as the normal one by Cruveilhier.

Remarks.—The deep position of the Psoas muscle in the abdomen and the thigh, as well as the yielding character of the tissues about it, determine the form and direction of a clot, or of an abscess occurring in the neighborhood of the muscle or in its substance. Inflammation within the muscle is frequently excited by contiguous disease of the lumbar vertebræ, or, more rarely, by infiltration of the connective tissue about the kidney. An infrequent cause is rupture of some of the fibres of the muscle by violent over-action. It is well known that, after death, the fibres of the Psoas are often lacerated by rough handling of the subject. It is possible, therefore, to conceive of laceration of the muscle by blows even when the muscle is at rest.

In a case reported by J. W. Grosvenor,[1] a few of the anterior fibres of this muscle were ruptured—a lesion which was followed by suppuration. The pus burrowed behind the muscle, and thence passed upward to a point between the stomach and liver, where it opened into the peritoneal cavity.

R. G. Butcher[2] found, in the case of a girl six years old, who perished by a venous hemorrhage into the sac of an old psoas abscess of the right side, that the clot occupied the iliac fossa, extending upward within one inch of the origin of the Psoas muscle, and downward along its course beneath Poupart's ligament, where it seemed to bifurcate; one branch of the coagulum lay beneath the conjoined tendon of the Psoas and Iliacus Internus muscles, and thence expanded so as to fill the entire sac of the abscess in the thigh; the other (being comparatively superficial) was situated to the inner side of the Sartorius muscle between it and the femoral vessels. The clot was defined inferiorly by the point where the Sartorius crosses the thigh. The position and limitation of the clot in the thigh illustrated the yielding character of the connective tissue in Scarpa's triangle as well as its continuity with the retro-peritoneal space.

Examples of pus following a similar course are not infrequent. The pus may lie in front of the muscle, and thence gravitate toward its insertion. It may form a rounded mass in the iliac fossa, or upon reaching the thigh may form a fluctuating mass to the outer side of Poupart's ligament and beneath the fascia lata. Dr. Gordon Buck[3] collected a number of illustrative cases of this phase of abscess, in none of which spinal disease existed. The Iliacus muscle was thought to be more intimately related to the abscess than was the Psoas. In females the exciting cause of the collection may be in an inflammation of the pelvic organs and of the connective tissue about them.

John Hilton[4] describes an abscess occurring be-

[1] N. Y. Med. Record, Dec. 2, 1867.

[2] Essays and Reports on Oper. and Conserv. Surg., Dublin, 1865, 340.

[3] N. Y. Journ of Medicine, 1857, 147.

[4] Lancet, Nov. 1860, 455; also Lectures on Rest and Pain.

neath the Iliacus, which descended into the thigh behind the tendon, and thence behind the femoral vessels in front of the hip-joint and toward the inner part of the thigh. In rare instances, the pus, after being guided by the common tendon its entire length, passes to the outer side of it, and collects beneath the Tensor Vaginæ Femoris and the anterior portion of the Gluteus Medius muscle.

Instead of following the course of the muscle beyond the pelvis, the pus may rupture the sheath and empty into the abdominal cavity, as in the case mentioned above. It may, indeed, rupture in more than one direction, pus passing downward behind the muscle as well as anteriorly into the abdomen. Mr. T. Holmes[1] reports a lesion of this kind in a boy eight years old.

Contracture of the Psoas may be excited by the presence of pus either within or alongside the muscle. In perinephritic abscess the value of this sign was determined by Bowditch;[2] while Benjamin Lee[3] invited attention to it in psoas abscess pointing at the groin.

In contracture the patient inclines the body forward when standing, and thus relieves the weight of the body upon the affected side. The heel is slightly raised, the toes alone touching the ground. Under these circumstances the vertebral column in the lumbar region is deeply curved forward, but without projection above, or it inclines from the affected side.

The bursa beneath the tendon of the Psoas and the Iliacus, when inflamed, may counterfeit disease of the hip-joint. In a case occurring under the care of the writer, an obscure flattened swelling existed over the joint, associated with local pain, lameness, and wasting of the affected limb. The swelling was believed to be due to an inflammation within the bursa.

THE ILIACUS INTERNUS.

The Iliacus Internus muscle arises from that portion of the iliac fossa which is bounded in front by a line from the anterior superior spinous process to the notch beneath the anterior inferior spinous process, as well as from the anterior two-thirds of the inner lip of the crest. It also arises from the sacro-iliac juncture, from the ilio-lumbar ligament and base of the sacrum, as well as from the anterior surface of the capsule of the hip-joint. From this extensive surface the fibres converge to be inserted, while still for the most part fleshy, into the lateral border of the tendon of the Psoas Magnus. It occupies the groove between the anterior inferior spinous process and the ilio-pectineal line. The fibres at this point are somewhat twisted. The lower ones have a distinct insertion into the trochanter minor. Beneath the common tendons of the two muscles there is a large bursa, which may communicate with the hip-joint.

Use.—See functions of Psoas Magnus.

Nerves.—These are derived from the main trunk of the anterior crural nerve.

Variations.—The lowest fibres are sometimes separate from the main muscle. They then arise from the anterior inferior spinous process and the anterior portion of the capsule, and are inserted into the trochanter minor.—The bursa is the largest in the body. It is oftener found to communicate with the joint in the aged than in the young. A second smaller one, *bursa iliaca*, is found beneath the tendon.

THE SARTORIUS.

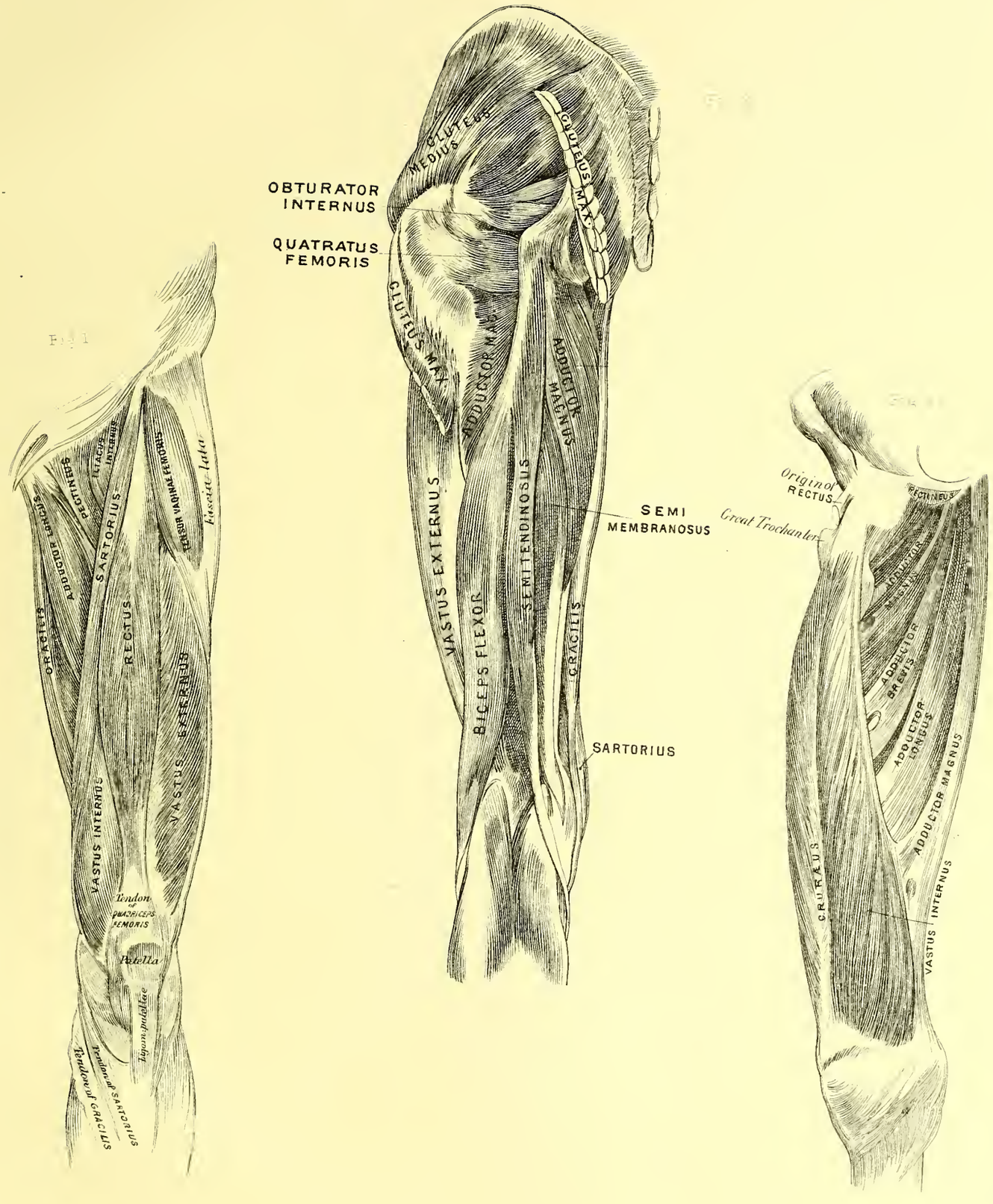
The Sartorius muscle arises from the anterior superior spinous process of the ilium and from a small portion of the adjacent bone. The long ribbon-shaped muscle passes downward and inward, crossing the front and gaining the inner side of the thigh, along which it descends nearly vertically on a line with the posterior margin of the internal femoral condyle. At this point it becomes tendinous, and, crossing the knee-joint, turns slightly forward, and is inserted by a broad thin tendon on the inner side of the head of the tibia and for a short distance below it. With the tendons of the Gracilis and the Semitendinosus, the Sartorius forms the broad aponeurotic sheet on the proximal inner surface of the leg; this sheet has received from French writers the name of *patte d'oie*.

[3] Med. Times and Gazette, Dec. 1862, 630.
[4] Boston Med. Surg. Journ., May 4, 1868.
[5] Trans. Med. Soc. Penna. 1876, 539.

EXPLANATION OF PLATE LIV.

Fig. 1. The muscles of the anterior surface of the thigh.
Fig. 2. The muscles of the buttock and those of the posterior surface of the thigh.
Fig. 3. The muscles on the median surface of the thigh.

PLATE LIV


OBTURATOR INTERNUS
QUATRATUS FEMORIS
GLUTEUS MEDIUS
GLUTEUS MAX.
GLUTEUS MIN.
ADDUCTOR MAG.
ADDUCTOR MAG.
VASTUS EXTERNUS
BICEPS FLEXOR
SEMITENDINOSUS
GRACILIS
SEMI MEMBRANOSUS
SARTORIUS
Fig 1
ADDUCTOR LONGUS
PECTINEUS
SARTORIUS
RECTUS
VASTUS EXTERNUS
VASTUS INTERNUS
Tendon of QUADRICEPS FEMORIS
Patella
Ligam. patellae
Tendon of SARTORIUS
Tendon of GRACILIS
Origin of RECTUS
Great Trochanter
PECTINEUS
ADDUCTOR BREVIS
ADDUCTOR LONGUS
ADDUCTOR MAGNUS
CRURAUS
VASTUS INTERNUS

Use.—The Sartorius muscle flexes the leg on the thigh, and the thigh on the pelvis. In the execution of these movements the femur is rotated slightly outward. In conjunction with the Gracilis, Semitendinosus, and Biceps muscles it assists in raising the foot from the ground, and may make tense the deep fascia of the leg.

Nerves.—The Sartorius receives branches of the middle cutaneous nerve, which enter on the median border by an imperfectly defined interlaminate space. A few distinct twigs from adjacent cutaneous nerves supply it further down.

The muscle, near its insertion, sends a fibrous slip to the capsule of the knee-joint and to the fascia of the leg. Two bursæ are found in relation with the tendon: one lies between the muscle and the internal femoral condyle; and the other lies beneath the *patte d'oie*.

Relations.—These, owing to the proximity of the muscle to the femoral artery, are important.—From its origin to a point on a hypothetical transverse line answering to the femoro-scrotal fold—a distance of about three inches—the muscle lies to the inner side of the Tensor Vaginæ Femoris, which protects and in a measure conceals it. It is crossed (sometimes pierced) by a branch of the middle cutaneous nerve. To the inner side (the thigh being extended) is the eminence of the head of the femur. Beneath lie the tendons of the Iliacus Internus and the Psoas. The muscle here lies well to the outer side of the sheath of the great vessels.—From the transverse line, at the point of chief nerve supply, to the inner side of the thigh, the muscle crosses the thigh obliquely. It here, at first, rests on the Rectus Femoris, and afterward on the Vastus Internus. Separated by a thick layer of deep fascia, it lies over the deep branches of the anterior crural nerve. It lies at first over and then to the inner side of the sheaths of the great vessels.—The remaining portion of the muscle in the thigh is nearly vertical, and lies in a deep sulcus defined by the Vastus Internus on the outer side, and by the Adductor Longus and Adductor Magnus muscles on the inner. The sheath of the great vessels is beneath the muscle above, and to the outer side below. Opposite the knee-joint and at its insertion it is in advance of and above the Gracilis and the Semitendinosus.—Beneath the muscle, near its insertion, is the long saphenous nerve.

When the head of the femur is drawn down, these muscles are relaxed, and the finger can be pushed in the hollow between them.

Variations.—It rarely presents a transverse inscription. Its belly may divide—one portion going to the posterior ligament of the knee-joint, or both portions going to the tibia; or a portion may be lost over the fascia of the Vastus Internus, or be inserted upon the femur.

THE TENSOR VAGINÆ FEMORIS.

This muscle arises from the anterior superior spinous process, and from the notch lying beneath, as well as from the anterior portion of the crest of the ilium. It forms a quadrilateral or triangular figure situated at the upper third of the thigh between the Sartorius and Gluteus Maximus muscles, with the latter of which it is intimately associated. It is inserted into the fascia lata at the junction of the upper with the middle third of the thigh.

Use.—The muscle first makes the fascia lata tense, in which act it is aided by the Gluteus Maximus. It exerts no appreciable influence in extension of the thigh, but induces to a limited extent flexion with rotation from without inward. It may thus turn the toes slightly inward when the foot is extended. The degree of this rotation is about equal to that effected by the Psoas. The thigh being fixed, the muscle can slightly aid in flexing the pelvis.

Nerve.—This is derived from the inferior branch of the superior gluteal.

The Variations of the Tensor Vaginæ Femoris are unimportant.

According to Barwell, the muscle can rotate the flexed leg outward.—Maissiat and H. Meyer consider the portion of the fascia lata lying between the Tensor and the tibia to be equivalent to a prolonged tendon of the former; the muscle has thus received the name of the Ileo-Tibiale. In emaciated individuals the tibial attachment of the fascia answering to this so-called tendon is sufficiently prominent to produce for a short distance above the tibia a ridge-like elevation of the skin.

THE QUADRICEPS EXTENSOR.

This muscle, as the name implies, is composed of four more or less distinct portions, namely, the Rectus Femoris, the Vastus Externus, the Vastus Internus, and the Crureus. The Rectus is of pelvic origin, the remaining three are femoral. The numerous fibres of the muscle all converge to act upon the patella, which may be considered to be a sesamoid bone within a tendon; this tendon, under the name of the ligamentum patellæ, is inserted into the tibia at the anterior tuberosity. The common tendon is received upon the front of the oblique proximal border of the patella.

The *Rectus Femoris* arises tendinously from the anterior inferior spinous process of the ilium, and by a distinct horizontal slip from the superior part of the

rim of the acetabulum. The muscle passes directly downward upon the front of the thigh, and is inserted by a broad thin tendon upon the upper portion of the patella.

The muscle is to a slight degree bi-laminate near its origin, and is obscurely bi-penniform at the upper anterior portion of its belly. Near the insertion it is fleshy, the fibres being nearly vertical. The tendon of origin resembles a ligament, and is free at the inner border. It runs down within the muscle at the upper third.—The acetabular head joins the main tendon at right angles, and is not free inferiorly, being here continuous with a thin aponeurotic slip which passes downward.—The posterior surface of the muscle is fibrous for its entire length.—The lower two-thirds of the posterior surface of the tendon of insertion receives at its outer edge the superficial fibres of the Vastus Externus, and to a much less extent receives muscular fibres from the Vastus Internus.

Relations.—The Rectus is the most isolated of the divisions of the Quadriceps. It lies superficial to them all in a groove between the two Vasti, and upon the Crureus.—In front, at its origin, are the Psoas and the Sartorius. Lower down, the fascia and the integument. In front of the acetabular tendon is the Gluteus Minimus. To the outer side are the Tensor Vaginæ Femoris and the Vastus Externus. To the inner side are the Vastus Internus, the Sartorius, and the Psoas. Behind lie the capsular ligament of the hip-joint, the Psoas, and the Crureus; between these and the muscle pass obliquely the external circumflex artery and a branch of the anterior crural nerve.

The entire muscle lies within a sheath of fascia, the anterior portion of which is the thicker.

The *Vastus Externus* arises from the base of the great trochanter, from a line leading thence outward and downward to the linea aspera, from the entire length of the outer lip of the linea aspera, and by short dispersed fleshy slips from the posterior surface of the sheath of the muscle at the lower third. In addition to these it derives fibres from the intermuscular septum between it and the short head of the Biceps Femoris, and from the posterior aspect of the femoral tendon of insertion of the Gluteus Maximus.

The muscle is inserted into the outer side of the patella and into the tendon of the Rectus Femoris. It forms a large fleshy mass extending along the entire length of the thigh upon its outer side, and is for the most part on a plane above that of the Vastus Internus and the Crureus, but below that of the Rectus Femoris. It is continuous with the Crureus at its posterior border, and joins the Rectus tendon below.

The fascia lata is properly not connected with the muscle. It is held to the muscle, it is true, by a tough layer of connective tissue, but presents no organic union. This union is firmer at the upper half of the muscle posteriorly than elsewhere. The intermuscular septum between it and the Biceps Femoris is pierced here and there by twigs of bloodvessels.

The muscle is fleshy externally and fibrous internally at its lower half or two-thirds, where it lies in contact with the tendinous surface of the Crureus. The fleshy slips from the sheath below are arranged for the most part external to a central shining tendon, very much in the manner that the superficial fibres of the Temporal muscle are disposed in relation to their tendon.

The *Vastus Internus* arises from an oblique line running from the front of the base of the neck of the femur to the linea aspera, from the internal lip of the same to the middle of the shaft, and from the tendon of insertion of the Adductor Magnus (internal intermuscular septum). The muscle forms a pyriform mass, having its apex above, and is inserted upon the inner border of the patella, and the corresponding border of the tendon of the Rectus Femoris.

The fibres are fleshy, and are upon the same plane as those of the Crureus. Those from the linea aspera are slightly tendinous. The upper muscular fibres are oblique; the lower nearly horizontal.—A fibrous layer, continued over the great vessels and the long saphenous nerve at the middle third of the thigh, is directed from the Vastus Internus to the Adductor Magnus, and forms the anterior boundary of Hunter's canal.

The Crureus is continuous with the preceding, and the two may be said to form one great mass. They are separated for convenience in description. W. Roger Williams[1] describes the Crureus as composed of four laminæ, each of which arises separately from the femur. The Subcrureus may be looked upon as a rudiment of a fifth lamina.

Relations.—In front are the Sartorius and branches of the anterior crural nerve; some of the latter penetrate the upper border of the muscle. The great vessels also lie in front. Near the knee the muscle lies beneath the fascia and skin. Behind lie the femur, and the tendons of insertion of the Adductor Longus and the Adductor Magnus. To the outer side are the Rectus Femoris and the Crureus. To the inner side are the femoral vessels, the Adductor Longus, and the Adductor Magnus.

The *Crureus* arises by fleshy fibres from the anterior and outer aspects of the shaft of the femur. It is more or less identified with both Vasti, particularly with the Vastus Internus. It is covered in front and to the outer side by the Vastus Externus, and along its inner border it is continuous with the fibres of the Vastus Internus which are on the same plane with its own. The muscle is inserted upon the upper border and sides of the patella.

[1] Journ. of Anat. and Phys., 1870.

The anterior surface at its lower two-thirds is fibrous.

Relations.—In front the Rectus Femoris and the Vastus Externus. To the inner side the Vastus Internus, and to the outer side the Vastus Externus. Behind it is the shaft of the femur.

The *Subcrureus* is a name given to a delicate bundle of fibres arising by fleshy slips from the anterior surface of the shaft of the femur a short distance above the patella, and descending thence to be inserted into the synovial pouch of the knee-joint.

Use.—When all the parts of the muscle act together, the leg is extended upon the thigh. In addition to the above action the Rectus aids in holding the head of the femur against the acetabulum when the body is erect. Its atrophy causes great difficulty in walking. To relax the Rectus the hip must be elevated and the knee extended.

The Vastus Externus draws the patella upward and outward. Its strength is greater than that of the Vastus Internus, which draws the patella upward and inward. When both act the patella ascends, aided by the Rectus and the Crureus. Dislocation of the patella is ordinarily outward, a fact readily explained by the greater strength of the Vastus Externus. It may be induced by rapid walking, jumping, dancing, etc., or by powerful contraction under electricity.

The Subcrureus makes tense the synovial prolongation beneath the tendon.

Nerve.—The Quadriceps Extensor is supplied by the anterior crural nerve.

As the extensions downward of the fascia lata reach the region of the patella they secure additional strength by union with fleshy fibres of the two Vasti muscles. Thus increased strength is secured to the sides and front of the knee-joint, and more or less influence, besides that directly secured through the line of its main tendon, is exerted upon the leg by the contraction of the Quadriceps.—A bursa lies beneath the aponeurosis over the patella; and another is seen lying between the skin and the aponeurosis directly over the first-named bursa.—A third bursa lies between the ligamentum patellæ and the tibia.

Remarks.—The Ligamentum Patellæ often furnishes signs of great value in the study of disease and injury. R. Olcemann found its relaxation and the wrinkling of the integument over it to be characteristic of fracture of the neck of the femur.—Any deviation of the tendon from the vertical line indicates, according to Holden, displacement of the tibia. The ligament is best seen in semi-extension, the foot being unsupported. When in this position, as when one sits with the limb under observation thrown over the knee of the limb of the opposite side, a smart blow is struck directly over the ligament, the patella, or the muscle directly above this bone, the leg and foot are perceptibly extended. This movement, which has received from Erb the name of "patellar tendon reflex," is absent as a rule in locomotor ataxia.[1]

The Ligamentum Patellæ can suffer spontaneous rupture, as shown in the following case: A man, aged thirty-one, in attempting to save himself from a violent fall backward, ruptured this tendon. The knee swelled after the accident and became painful, the patella being drawn up an inch.[2]

The entire muscle may undergo partial atrophy or loss of tone after fracture of the patella.[3]—The Rectus Femoris may be ruptured[4] or undergo atrophy in chronic contracture of the Biceps Flexor in children (Duchenne).

The Internal Femoral or Adductor Muscles.

The muscles of this group embrace—

The Gracilis.
The Pectineus.
The Adductor Longus.
The Adductor Brevis.
The Adductor Magnus.

THE GRACILIS.

This muscle arises by a thin broad tendon from the pubis close to the suspensory ligament of the penis, and from the entire border of the descending ramus of the pubis. It passes down the inner side of the thigh, and becomes tendinous at about the middle or lower third to form a rounded tendon which passes downward parallel with the Sartorius, below the internal condyle, where it is expanded into a broad aponeurosis to be inserted into the median surface of the shaft of the tibia. A bursa lies between the muscle and the internal lateral ligament.

Use.—The Gracilis adducts the thigh, flexes the leg upon the thigh, and rotates the thigh from without inward.

Nerve.—The Gracilis is supplied by the obturator nerve.

Relations.—The muscle is subcutaneous. To the outer side lie the Adductor Brevis, from which it is separated by fascia, and the Adductor Magnus. At the lower third of the

[1] See G. Steward, Med. Times and Gazette, Jan. 1878, and W. R. Gowers, Medico-Chirurgical Trans., 1879, 269.

[2] Bryant's Surgery, 901.

[3] Jonathan Hutchinson, Med.-Chir. Trans., lii. 340.

[4] Sédillot, Mém. et Prix de la Soc. de Méd. de Paris, 1817.

thigh the Sartorius lies to its inner side and in front. To the outer side, from the middle of the thigh, lies the Semimembranosus.

The Gracilis is singularly constant.

THE PECTINEUS.

The Pectineus musele arises from the entire length of the erest of the pubis, from the pubie spine, and in part from Gimbernat's ligament. A deep fasciculus arises from the upper border of the obturator foramen and from the space between it and the base of the spine of the pubis. The musele passes downward and slightly outward, gradually entering a plane deeper than that of its origin, and is inserted by a broad thiek tendon into the femur on a line extending from the beginning of the linea aspera (spina trochanteriea minor) to the lesser troehanter.

The muscle is covered at its origin by a well-defined fascia, which is continuous with the faseia lata, and from which some of the museular fibres arise. The tendon of insertion is smooth and aponeurotic. The musele is fleshy above, where it may be readily torn by rough handling; but is firmer and more aponeurotic near the insertion. It is entirely fibrous where it lies in contact with the trochanter minor.

The muscle may be divided into two layers, more or less perfect above, the superficial and the deep. The superficial or flat portion (supplied by a branch of the anterior crural nerve) is that described as arising from the pubic bone. The deep or slender portion (supplied by a branch of the obturator nerve) is that seen arising from the upper border of the obturator foramen. A well-defined layer of fascia separates the two portions. This division is maintained in some lower animals.

Relations.—In front lie the femoral vessels and the fascia lata. Beneath, separated by a well-defined fascia, are the obturator artery and nerve, and the External Obturator and Adductor Brevis muscles. To the outer side is the Psoas Magnus, to the inner is the Adductor Longus. A small museular artery, an ascending branch of the internal circumflex, often runs upward along the inner border of the muscle. —The tendon is applied directly to the trochanter minor in rotation inward, and is in eontact on its inner side with the tendon of the Adduetor Brevis.

Use.—To draw the femur inward and forward as in erossing the limbs. It is thus a flexing adductor.

Nerve.—The musele is supplied by the obturator and anterior crural nerves.

Variations.—The muscle may receive a slip from the Adductor Longus and Iliacus Internus, as well as send a slip to the Obturator Externus and the eapsule of the hip-joint.—It may join the Iliacus Internus in its insertion at the trochanter minor. A slip may pass in front of the femoral vessels.

THE ADDUCTOR LONGUS.

This musele arises tendinously from the pubic bone between the spine and the symphysis. It is a flat fleshy muscle whose edge is turned upward and inward, and passes downward and outward, becoming broader as it does so, to be inserted by a flat, thin tendon into the femur at the middle third of the linea aspera. The tendon unites with the Vastus Internus and with the tendon of the Adductor Magnus. It sends a slip to the Adduetor Magnus.

The tendon of origin is robust, and resembles a ligament. It is produced along the inner border for a short distance, but thence to about the middle of the muscle (where it disappears) it is concealed.—The tendon of insertion is aponeurotic. Three layers of tendinous fibres are seen at the insertion; one anterior, one posterior, and one intermediate.

Relations.—In front, and to the outer side, lie the femoral vessels, a portion of the Sartorius muscle, and a thinned extension of the fascia lata. Behind it lie the Adductor Brevis, and below, the Adductor Magnus, with which it is continuous. To the outer side, above, and on a deeper plane is the Pectineus. To the inner side, above, lies the Gracilis.—The Adductor Longus forms the inner side of Searpa's triangle.—After the faseia lata has been cut through along the subcutaneous surface of this muscle the finger can isolate the Adductor Longus from the contents of the triangle, and roughly define the branches of the profunda femoris as they enter the Adductor group of muscles.

Use.—To adduct the femur and thus to assist the other muscles of its group.

Nerve.—The musele is supplied by the obturator nerve.

By abducting the thigh the tendon of the muscle is made tense and prominent, and, in this condition, has been claimed by Holden to be a useful guide to the spine of the pubis, and this in turn to the position of the external abdominal ring. Haneock[1] mentions three instanees of rupture of this musele oeeurring as a result of sudden and violent contraction attending the effort of riders to retain their seats on jumping or lunging horses. The tendon of origin is often divided subcutaneously by the surgeon for eontracture accompanying hip-joint disease.

Variation.—It may undergo cleavage throughout, both longitudinal and planal. It may receive an accession from the Pectineus.

THE ADDUCTOR BREVIS

muscle arises from the base of the pubic spine and from the entire length of the deseending ramus at the symphysis. It forms a thiek stout belly, whieh is

[1] Anat. and Surg. of Human Foot, 1873, 99.

directed downward and outward, slightly increasing in breadth, and is inserted into the inner lip of the linea aspera, or into a line extending thence to the inner side of the base of the trochanter minor.

Use.—To adduct the femur.

Nerve.—This is derived from the obturator nerve.

Relations.—The muscle lies beneath the Adductor Longus and the Pectineus, and a small portion of the Gracilis, and the anterior branches of the obturator vessels and nerves, which lie on this muscle rather than in the space between it and the Adductor Longus.

The muscle, from its origin at the pubic spine, is fleshy, and at its origin from the descending ramus of the pubis it is thin and aponeurotic. At the insertion the upper portion is tendinous and aponeurotic, the remaining portion is fleshy. —A few fibres of the muscle may arise from the under surface of the origin of the Gracilis.

Variations.—The muscle may fuse with the Adductor Magnus. It may be divided into two or three parts.

THE ADDUCTOR MAGNUS.

The Adductor Magnus muscle arises from the descending ramus of the pubis, from the ascending ramus of the ischium, and by a robust bundle of fibres from the anterior portion of the tuberosity of the ischium. The fibres pass for the most part downward and outward, and are inserted into the entire length of the median lip of the linea aspera below the Quadratus Femoris.

Use.—The Adductor Magnus is the main adductor of the thigh. Its lower part rotates the femur inward. Atrophy of this portion causes the foot to turn a little outward when the limb hangs vertically. When the action of the Adductor Magnus and of the Adductor Brevis and Adductor Longus is suspended, the limb swings a little obliquely outward during the second movement of the act of walking.

Nerves.—These are derived from the obturator nerve and from short branches of the great sciatic.

The fibres which arise from the pubis and the front part of the tuberosity pass horizontally outward, and are inserted into a line extending from the middle of the intertrochanteric line to the linea aspera. Those arising from the inferior margin of the pelvis and the ischial tuberosity pass downward and outward to be inserted into the linea aspera for its entire length, into its inner lip below, and by a vertical slip into the tubercle at the inner margin of the shaft near the inner condyle; and also to be attached at the lower third of the femur together with the Vastus Internus muscle and the internal intermuscular septum.—The muscle is pierced by the femoral vessels at the lower third, elsewhere by the perforating arteries.—The ischial origin is conspicuously fibrous posteriorly.

Luschka describes the fibres of the muscle as spiraliform.

According to Sappey, a bursa underlies the horizontal fibres as they pass over the trochanter minor.—H. Meyer[1] proposes for that portion of the muscle pierced by the branches of the profunda femoris artery the name Adductor Perforatus.

Relations.—In front are the Adductor Longus, the Adductor Brevis, and the femoral artery and nerve. At the middle third, and thence to the lower third, is the long saphenous nerve. A large branch of the profunda lies in front of the upper half. Behind lie the hamstring muscles and the great sciatic nerve. Behind, and to the outer side at the lower third, are the femoral head of the Biceps, and the popliteal artery and vein. The femoral sheath passes rather between the median and lateral divisions than through the muscle. The cord-like tendon, below the point of entrance of the femoral artery, is crossed by several of the cutaneous nerves.

Variations.—The muscle may fuse with the Quadratus Femoris. Horizontal cleavage may in great part separate the median fibres, which are inserted into the femoral condyle, from the lateral, which are inserted into the linea aspera.

Muscles of the Leg and the Foot.

The muscles of the anterior region of the leg and the foot include—

The Tibialis Anticus.
The Extensor Proprius Pollicis Pedis.
The Extensor Longus Digitorum Pedis.
The Peroneus Tertius.
The Extensor Brevis Digitorum Pedis.

THE TIBIALIS ANTICUS.

The Tibialis Anticus muscle arises from the proximal two-thirds of the lateral surface of the shaft of the tibia, from the tibial tubercle, from the septum between the muscle and the Extensor Longus Digitorum, from the fascia of the leg, and from the interosseous membrane. The muscle is pyriform; the stout tendon becomes free at about the middle of the leg, and passes at first vertically downward, then obliquely across the front of the leg beneath the annular ligament, to be inserted at the tubercle of the first cuneiform bone and at the proximal end of the first metatarsal bone. The muscle is superficial throughout. The tendon lies in a loose synovial sheath, and, owing to the circumstance that the annular ligament lies loosely over it, is, in the living subject, the most conspicuous of all the tendons crossing the front of the ankle.

Use.—To flex the foot and at the same time to rotate it a little inward on its longitudinal axis so

[1] Anatomie; also Zeit. für Anatomie und Entwickelungsgeschichte, 1876, 29.

that the median border is somewhat elevated. In conjunction with the Extensor Longus Digitorum and the Extensor Proprius Pollicis the muscle flexes the foot only. In the act of riding, the Tibialis Anticus assists in maintaining the foot in the stirrup. The muscle is antagonized by the Peroneus Longus.

Nerve.—It is supplied by the anterior tibial nerve.

The Tibialis Anticus is greatly compressed from side to side, being widest at the superficies of the leg and narrow at the interosseous membrane.—A fibrous slip passes from the tendon of insertion to strengthen the ligaments at the median border of the foot.—A bursa lies beneath the tendon of insertion.

Remarks.—In *talipes varus* the tendons of the Tibialis Anticus, and of the muscles which extend the toes as they lie in front of the ankle-joint, incline to the median side of the leg; and the tendon of the Tibialis Anticus as it crosses the joint is placed in a marked degree to the same side. In pronounced cases the tendon passes obliquely downward across the inner malleolus and inclines backward toward the first cuneiform bone.—In the adult, the subject of *talipes varus*, the tendon of this muscle passes obliquely downward and backward on the surface of the inner malleolus, and takes a curved direction inward and backward to its insertion. As the tendon crosses the ankle-joint it passes in an oblique direction from the inner malleolus behind rather than in front of the process. This, in the judgment of Mr. Adams, is an exceedingly important point, since the tendon in a normal foot is found below and in front of the inner malleolus.

L. A. Sayre[1] found atrophy of the Tibialis Anticus associated with contracture of the peroneal muscles.

Variations.—The muscle may undergo partial cleavage. The tendon may be rarely inserted into the neck of the astragalus, but more frequently into the first metatarsal bone. A slip may join the Extensor Brevis Digitorum Pedis, or the Extensor Proprius Pollicis Pedis. A fascicle may be separated from the anterior portion of the muscle, which (or a fibrous slip from its tendon) is inserted either into the annular ligament or the fascia dorsalis pedis. This slip is probably related to the more anterior of the two anterior tibial muscles of Echidna.

Relations.—In the leg the Tibialis Anticus lies upon the tibia, upon the interosseous membrane, upon the proximal portion of the Extensor Proprius Pollicis, and to a less extent upon the Extensor Longus Digitorum. To the median side are the tibia, and to the lateral the Extensor Proprius Pollicis. Between the muscle and the Extensor Proprius Pollicis are the anterior tibial vessels and nerve. At the ankle the tendon lies directly beneath the integument to the median side of the anterior tibial vessels and nerve.

[1] Orthopædic Surgery and Diseases of the Joints, 64.

THE EXTENSOR PROPRIUS POLLICIS PEDIS.

The Extensor Proprius Pollicis Pedis muscle arises from the middle two-fourths of the narrow anterior border of the fibula, but secures most of the fibres from the interosseous membrane. Its fascicles are directed obliquely forward and downward, and the tendon, passing beneath the annular ligament in a distinct compartment, is inserted into the second phalanx of the first toe.

Use.—To extend the first toe.

The muscle is distinctly penniform, the tendon lying anteriorly.

Variations.—The muscle may undergo longitudinal cleavage. It may send a slip to the Extensor Communis Digitorum. A delicate fascicle, as a rule, is sent from the inner border of the tendon, at its insertion, to be inserted on the base of the first phalanx of the great toe at the side of the metatarso-phalangeal joint. A bursa commonly underlies the tendon at the instep.

Nerve.—The nerves are derived from the anterior tibial nerve.

Relations.—The muscle lies in a sulcus between the Tibialis Anticus and the Extensor Longus Digitorum. In front of the ankle it crosses the anterior tibial vessels and nerve. On the dorsum of the foot it overlies some of the deeper veins, and, along the median border, the dorsal ligaments.

EXTENSOR LONGUS DIGITORUM PEDIS.

The Extensor Longus Digitorum Pedis muscle arises from the head and the proximal three-fourths of the

EXPLANATION OF PLATE LV.

Fig. 1. The muscles on the lateral and anterior surfaces of the leg and the foot.

Fig. 2. The muscles of the ham and the posterior surface of the leg.

Fig. 3. The same, showing a deeper layer of the muscles of the leg.

Fig. 4. An additional study of the muscles on the median surface of the thigh.

T. Sinclair & Son Lith.

Fig 1

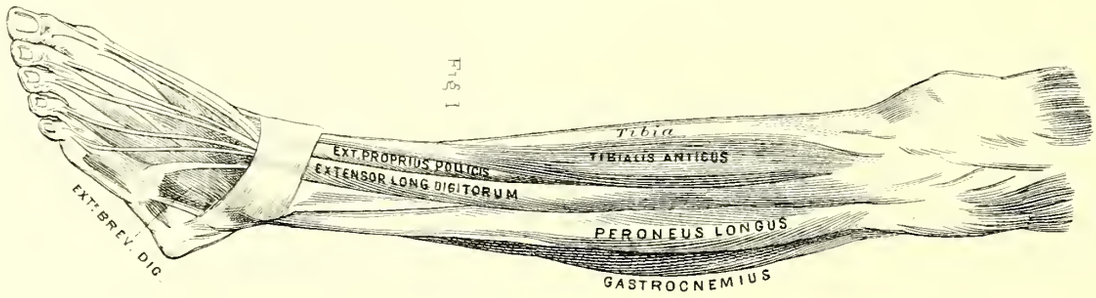


Fig 2

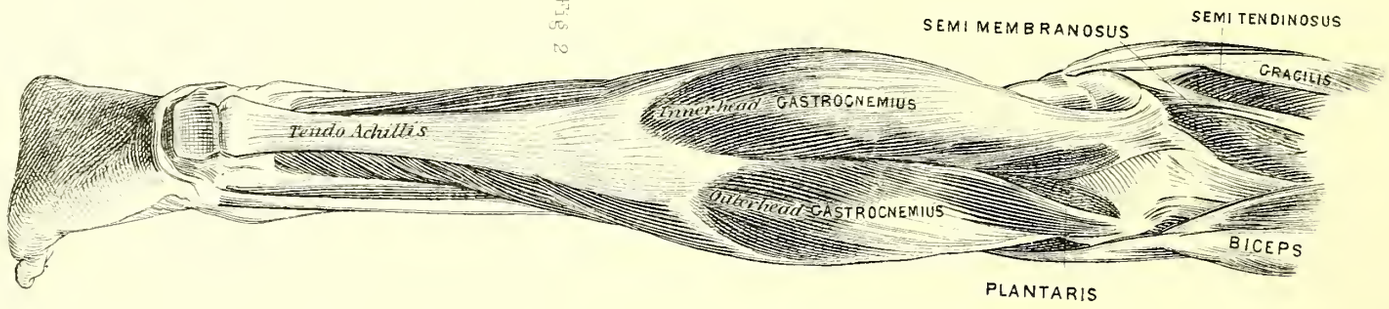


Fig 3

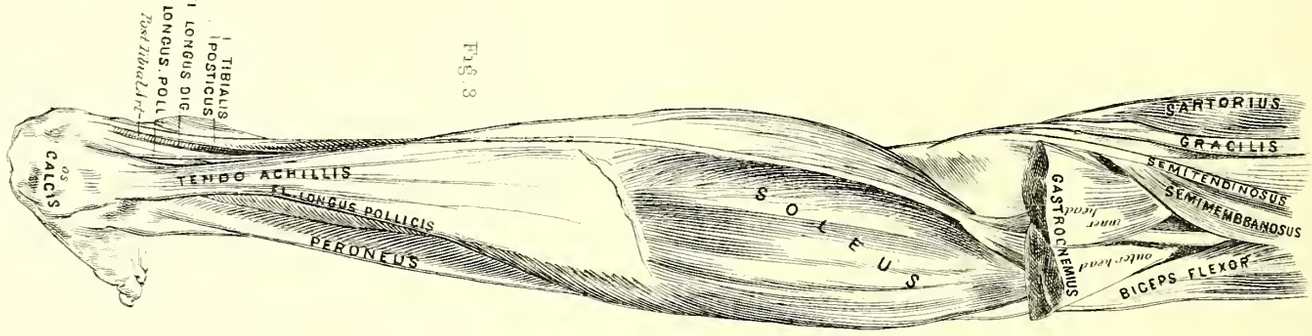


Fig 4

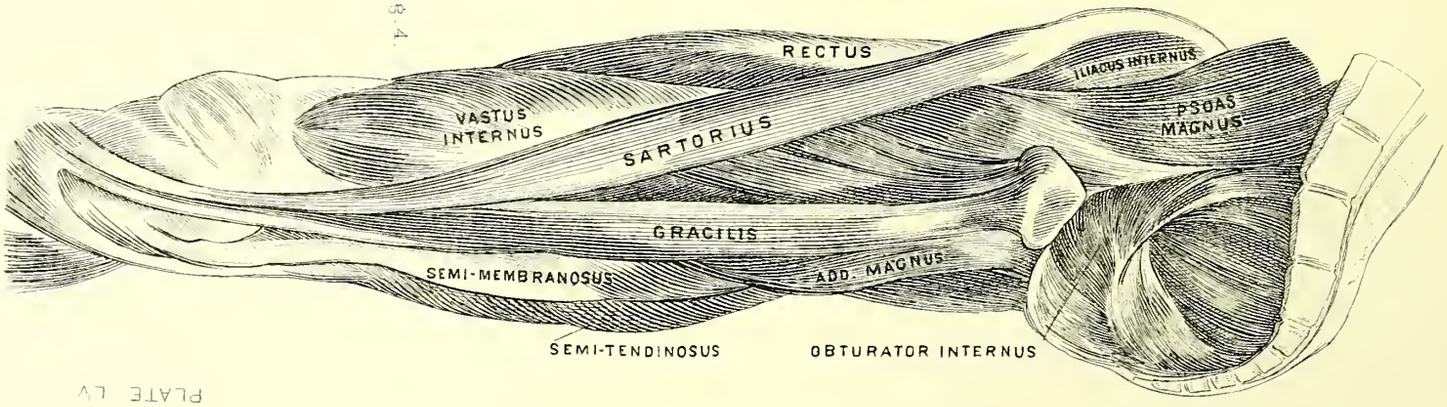


PLATE LV

anterior border of the fibula, from the external tuberosity of the tibia, from the fascia of the leg, from the septum between the muscle and the Tibialis Anticus, and from the septum between the muscle and the Peroneus Longus and the Peroneus Brevis. An important accession is secured from the interosseous membrane. The tendon passes beneath the annular ligament, sometimes in a sheath in common with that of the Extensor Proprius Pollicis, but oftener in a separate compartment, to reach the dorsum of the foot, where it divides into four tendons which are inserted on the dorsal aponeuroses of the second, third, fourth, and fifth toes. Each of the tendinous expansions receives the tendons of insertion of the Interossei and Lumbricales muscles.

Use.—To extend the four outer toes and to abduct and to flex the foot. Acting with the Tibialis Anticus the muscle flexes the foot. The foot is flexed and adducted, or abducted, according to the action of the other muscles. When the Gastrocnemius and the Soleus are atrophied, the Extensor Longus Digitorum, acting in conjunction with the Peroneus Longus, barely brings the foot to a right angle with the leg.[1]

Nerves.—The muscle is supplied by numerous small nerves from the anterior tibial nerve; these for the most part pierce the Extensor Proprius Pollicis for the purpose. A separate long nerve from the same source supplies the deep surface of the muscle.

At its origin the muscle is fusiform at the anterior border, but soon becomes penniform—the tendon lying at the anterior border—and is compressed laterally.—Each tendon splits into three slips at the base of the first phalanx. The median slip is inserted into the lateral edge of the second phalanx; the remaining slips unite upon the dorsal surface of the second phalanx, and are inserted upon the lateral border of the third phalanx.[2]

The tendon of the Extensor Longus Digitorum for the second and fourth toes is free at the lower third of the leg. It can be traced within the muscle as far as the upper fifth. The tendons for the fifth toe and fifth metatarsal bone (Peroneus Tertius) are distinct from the above and less extensive. Each of the tendons, excepting the last, is joined laterally by a tendon of the Extensor Brevis Digitorum.—Two bursæ are sometimes seen in connection with the Extensor Longus Digitorum, one lying beneath the annular ligament at the lateral edge of the tendons, and another between the tendons and the head of the astragalus.—The Extensor Longus Digitorum and the Extensor Brevis Digitorum are often rudimentary, or in a state of fatty degeneration, in congenital *talipes varus*.

Variations.—Partial longitudinal cleavage may separate the fibular and the tibial slips.—The remaining variations pertain to the tendon of insertion. A tendon may be inserted on the first toe. A slip may pass to the first phalanx of the second toe, and to the fifth metatarsal bone. Slips may be derived from the Flexor Brevis Digitorum and from the Peroneus Brevis. The tendon to the fifth toe may be duplicated. The muscle may arise from the fibula for its entire length.

The so-called Peroneus Tertius may fuse with the proper Extensor Longus Digitorum. It may be absent, when the latter muscle takes its place. The slip to the fifth toe may be absent. The muscle may send a slip to the Extensor Brevis Digitorum.

Relations.—To the lateral side is the Peroneus Longus. To the median side, near the proximal third of the leg, lie the Tibialis Anticus, and in the middle third the Tibialis Anticus and the Extensor Proprius Pollicis. The latter underlies the Extensor Longus Digitorum in great part as well. At the ankle the tendons overlie the anterior tibial vessels and nerve. The tendon of the Extensor Proprius Pollicis lies to the median side. On the dorsum of the foot the tendons overlie the Extensor Brevis Digitorum.

THE EXTENSOR BREVIS DIGITORUM PEDIS.

This muscle arises from the upper and outer surfaces of the anterior portion of the calcaneum. It receives an accession from the anterior annular ligament. It crosses the dorsum of the foot obliquely, and divides into four slips which end in delicate tendons and are inserted into the four inner toes. The slip to the great toe is larger than the others, and its tendon is attached to the proximal extremity of the first phalanx. The remaining tendons are inserted into the lateral borders of the tendons of the Extensor Longus Digitorum. A bursa lies near the sinus tarsi beneath the muscle.

Use.—To extend the toes. The muscle is secondary in its action to the Extensor Longus Digitorum. Its oblique direction from without inward counteracts the inward traction of the long extensor, the tendons of which lie on the dorsum of the foot obliquely from within outward.

Relations.—The groove for the Peroneus Brevis lies behind the line of origin of the muscle.

Nerve.—It is supplied by the anterior tibial nerve.

Some of the fibres of origin can be traced in the *sinus tarsi* to the interosseous astragalo-calcaneal ligament. Other fibres may arise from the superior calcaneo-cuboid ligament.

[1] Duchenne, Physiologie des Mouvements.

[2] THE PERONEUS TERTIUS.—Under this head some authors give the following arrangement of fibres of the Extensor Longus Digitorum: This so-called muscle arises from the distal portion of the median surface and the anterior border of the fibula. The tendon becomes free beneath the annular ligament, and is inserted on the proximal end of the fourth metatarsal bone, a slip being received on the fifth.

Variations.—The slip to the first toe is often distinct from the rest of the muscle. A slip may pass to the fifth toe. Some of the slips may be absent.

The Muscles of the External (Fibular) Region of the Leg and Foot.

The muscles of the external (fibular) region of the leg and foot include—

The Peroneus Longus.
The Peroneus Brevis.

THE PERONEUS LONGUS.

The Peroneus Longus muscle arises from the lateral and anterior surfaces of the head of the fibula, from the upper third to one-half of the fibula, by extensive oblique fibres from the septum between the muscle and the Extensor Longus Digitorum, and by relatively unimportant fibres from the head of the tibia and the Soleus and Flexor Longus Pollicis muscles.[1] From this extensive origin the muscle passes downward along the lateral border of the leg; the tendon becomes free at about the lower third of the fibula, and is directed behind the external malleolus, about which in company with the tendon of the Peroneus Brevis it turns to gain the outer side of the calcaneum, and the lateral border of the cuboid bone. It is thence deflected abruptly around the sole of the foot in a groove on the under surface of the cuboid bone to be inserted on the base of the first metatarsal bone.

Use.—To extend and abduct the foot and to turn the plantar surface somewhat outward, thus depressing the inner border of the foot. Acting with the Gastrocnemius and the Soleus it directly extends the foot. It is antagonized by the Tibialis Anticus, and in part by the Gastrocnemius and the Soleus.

C. Hueter[2] has made an elaborate study of the function of the Peroneus Longus and of other muscles supplied by the peroneal nerve. The actions, as observed by him, were modified by traumatic paralysis of the anterior tibial nerve.

Nerve.—The muscle is supplied by the musculocutaneous branch of the popliteal nerve.

The muscle is stout at its origin from the head of the fibula, but is thin and sheet-like as it arises from the shaft of the fibula.—While passing along the groove of the cuboid bone the tendon is secured from dislocation by a layer of the calcaneo-cuboid fascia or ligament. Nevertheless, such a dislocation is possible according to Bryant,[1] who quotes an instance.—At the ankle the tendon is held to the lateral side by an exceptionally broad and stout *vinculum* carrying bloodvessels. The tendon of the Peroneus Brevis is connected to that of the Peroneus Longus by a similar sheet.

Variations.—The Peroneus Longus may send slips to the fifth, first, or third metatarsal bone; to the first cuneiform, or to the cuboid bone, or to the external malleolus. It may fuse with the Peroneus Brevis. It may receive a slip at the origin from the Biceps Flexor.—A small slip of insertion may be continuous with the First Dorsal Interosseous muscle, and afford a small surface of origin for the Flexor Minimi Digiti.—At the main points of friction of the tendon, namely, at the external malleolus and at the groove of the cuboid bone, a sesamoid cartilage is not infrequently developed.—The lower of these nodules may undergo ossification.

Relations.—To the inner side lies the Extensor Longus Digitorum, to the outer side are the Soleus and the Flexor Longus Pollicis. The Peroneus Longus overlies the fibula and the Peroneus Brevis. At the ankle it lies in the same sheath with the Peroneus Brevis. In the foot it lies beneath the Abductor Minimi Digiti and the Adductor Pollicis.

Contracture of the Peroneus Longus depresses the internal border of the foot, and creases the integument of the sole, while the foot itself is abducted and rests upon the inner side. The internal malleolus is under these conditions unduly prominent. An instance described by Duchenne followed chorea, and was cured by faradization of the antagonistic muscles.

When the Gastrocnemius and the Soleus are atrophied, the Peroneus Longus, acting with the Extensor Communis Digitorum, can extend the foot at a right angle to the leg.

Atrophy of the muscle is followed by inclination inward of the plantar surface. In attempting to bring the sole of the foot to the ground, the great toe is involuntarily flexed. Thus a corn is developed upon the under surface of this toe. Flat foot follows in time.

In *talipes varus* the tendon of the Peroneus Longus runs below the calcaneum in a special groove, and does not lie upon the cuboid bone, which is without a groove.

THE PERONEUS BREVIS.

The Peroneus Brevis muscle arises from the lower half or two-thirds of the outer surface of the fibula by close-set muscular fibres, from the intermuscular

[1] The fibres of origin arrange themselves into two sets or imperfect laminations. The superficial or upper lamina arises from the head of the fibula and the head of the tibia, and is in part continuous with the Biceps Flexor. The deep or lower lamina arises from the remaining parts as described in the text. In the space between the laminæ the external peroneal nerve enters.

[2] Langenbeck's Archiv für Chirurgie, vol. vii. 1866, 827, fig.

[1] Surgery, 900.

septum between the Extensor Communis Digitorum and the Peroneus Tertius on the median side, and by a few unimportant fascicles from the Flexor Longus Pollicis on the lateral. The muscle passes downward, and becomes entirely tendinous at the level of the external malleolus, although the broad stout tendon extends partially concealed higher up the leg; it passes behind the external malleolus in company with the Peroneus Longus muscle to gain the outer side of the calcaneum, on the lateral surface of which it lies in a shallow oblique groove above a corresponding groove for the Peroneus Longus muscle, and is inserted upon the lateral process of the fifth metatarsal bone. A tendinous slip passes from the tendon of insertion to the base of the first phalanx of the fifth toe. Others ordinarily join the rudimentary fascia on the dorsum of the foot, or unite with the tendons of the extensors of the toes.

The sheaths and the vincula at the outer side of the ankle are so stout that they naturally assist the tendons of the Peroneus Longus and Peroneus Brevis in supporting the external lateral ligament.

Use.—To abduct the foot. Acting together with the Peroneus Longus, it aids in pronation, and together with the Tibialis Anticus in extension.

Nerve.—The muscle is supplied by the musculocutaneous branch of the popliteal nerve.

Variations.—Slips may join the Peroneus Longus and the Abductor Minimi Digiti. The tendinous slip to the fifth toe may be absent, or be compensatory with a slip from the Peroneus Tertius.

The Muscles of the Posterior Region of the Leg and Foot.

The muscles of the posterior region of the leg and foot include—

- The Gastrocnemius.
- The Soleus.
- The Plantaris.
- The Popliteus.
- The Flexor Longus Digitorum Pedis.
- The Flexor Accessorius.
- The Lumbricales.
- The Flexor Longus Pollicis Pedis.
- The Tibialis Posticus.

THE GASTROCNEMIUS AND SOLEUS.

The Gastrocnemius muscle arises tendinously by two heads from the femur, the larger inner head from above the inner condyle, and the outer head from above the lateral aspect of the outer. The two heads unite at the upper third of the leg, and are inserted by a broad aponeurosis upon the Soleus.[1]

The Soleus muscle arises from the posterior surface of the head of the fibula, from about the upper half of the outer border of the fibula, from the oblique line of the tibia, and from an arch of fibres which extend from the tibia to the head of the fibula. The muscle descends to form a massive tendon (tendo Achillis) about one and a half or two inches in length, which is inserted into the lower part of the tuberosity of the calcaneum.

Use.—The Gastrocnemius and the Soleus extend the foot at the same time that they produce a pivot movement in the ankle, to which is due the fact that the toes are carried inward and the heel outward; the outer border is at the same time depressed, and the foot is turned inward. The Gastrocnemius feebly flexes the leg on the thigh. When the leg is flexed on the thigh the muscle can extend the foot. The muscle acts in harmony with the Soleus, and in atrophy of this muscle is ineffective. When both muscles are atrophied the heel is depressed and the Peroneus Longus over-active. The action of the Gastrocnemius through its origin is to relax the capsule of the knee-joint.

Nerve.—The Gastrocnemius is supplied by a number of short nerves from the popliteal. The Soleus is supplied at the popliteal space by a single long nerve from the same trunk, which, as it descends, overlies the Plantaris muscle, and by a second smaller nerve which arises from the posterior tibial nerve in the calf of the leg.

Variations.—A sesamoid bone may be found in each of the two heads of the Gastrocnemius, but more commonly in the outer.[2] It may undergo incomplete longitudinal or complete planal cleavage. It may receive an accessory slip from the Biceps, and a few slips from the capsule, and have a third head from the femur or the capsule of the knee-joint.

Variations in the Soleus embrace planal cleavage in the origin from the head of the fibula. It may not fuse with the Gastrocnemius, and, in such an instance, may be inserted, separately therefrom, into the tuberosity of the calcaneum.—A few slips, arising from the deep tibial fascia, may be inserted into the inner side of the tendo Achillis, or pass to the annular ligament.—The origin from the oblique line is unimportant; this line is chiefly occupied by the Flexor Longus Digitorum and the Popliteus.

[1] This union is not bi-penniform, for no central tendon exists. It is composed of the expanded aponeurosis of the outer head which receives upon its superficies the fibres of the inner head.

[2] For an elaborate study of these bones see W. Gruber, Mém. de l'Acad. Imp. des Sciences. St. Petersbourg, 1876.

The outer head of the Gastrocnemius arises chiefly from the corresponding femoral condyle and from a small portion of the long external lateral ligament; the inner head arises directly behind the inner condyle, and is intimately associated with the capsule, entertaining in this respect the relation held by the Plantaris to the capsule over the outer condyle.—The inner head is obscurely bilaminate, the laminæ being in great part fused. The deep layer is directly continuous with the aponeurotic extension of the under portion at its insertion, while the superficial layer is directly continuous with its proximal border. The nerves and vessels enter between the laminæ. The outer head is not bilaminate.—From the fact that the outer head is the most constant, and is the sole head present, as a rule, in the lower animals, it may be regarded in the light of the main or ancestral head, to which the inner head has been subsequently added.

The Soleus is composed of three groups of muscular fibres. The median portion of the muscle is occupied by the first of these groups, and is composed of oblique fibres arising from the tibia. The lateral portion constitutes the second group, and arises from the fibula, while a third and smaller group lies between the two. The fibres of the groups are arranged obliquely to the longitudinal axis of the muscle, and those belonging to the first and the second are separated on the posterior surface of the muscle by the edge of a portion of a concealed tendon.

Relations.—The inner head, at its origin, overlies the stout tendon of the Semimembranosus. At and below the head of the tibia the inner head is loosely held throughout its entire extent to the tibia by the deep fascia and the tendons of the Gracilis and Semitendinosus muscles.

The Gastrocnemius overlies the Soleus, Plantaris, and Popliteus muscles, and in part the capsule of the knee, the popliteal vessels, and the internal popliteal nerve. The two heads form the inferior boundaries of the popliteal space. The popliteal nerve lies close to the inner side of the outer head.—To the outer side of the outer head lies the Biceps Flexor; to the median side of the inner head lie the hamstring tendons.—The Soleus lies over the posterior tibial fascia, and a space, crossed by a few bloodvessels and occupied by loose connective tissue, separates this fascia from the fibrous posterior surface of the Soleus.

The tendo Achillis is separated from the calcaneum by a bursa, and from the sheaths of the remaining tendons by a quantity of connective tissue.

In Talipes Equinus the tendon inclines toward the fibula.

The tendon is held in position by a girdle-like formation of deep fascia, and, as long as it is thus held, tends to be slightly curved.—In separation of the distal epiphysis of the tibia the slight curve in the tendon is exaggerated.[1] To the inner side of the tendon lie the posterior tibial vessels and nerve.

[1] R. Quain, Brit. Med. Journ., Aug. 31, 1867.

THE PLANTARIS.

The Plantaris musele arises from the posterior surfaee of the outer eondyle of the femur, and from the eapsule of the knee-joint in the same neighborhood. It forms a slender belly that soon ends in a delieate narrow tendon which is inserted into the calcaneum at the median side of the tendo Achillis.

Use.—To aid the action of the Gastroenemius.

Nerve.—The nerve of the Plantaris is derived from the internal popliteal.

Remarks.—This musele has been known to be spontaneously ruptured, producing a peculiar dragging of the foot with eversion.

Relations.—The muscle at its origin lies to the median side of the outer head of the Gastrocnemius, and beneath the Soleus and the Gastrocnemius. It crosses the Popliteus muscle to gain its inner side, and along the corresponding side of the tendon of this muscle it descends to its insertion.

Variations.—The Plantaris is sometimes absent. Its belly may be inseparable from the outer head of the Gastrocnemius. Its tendon may be blended with the tendo Achillis, or be lost between the Gastrocnemius and the Soleus. Its origin may shift slightly downward, but retain its propinquity to the knee-joint. It may be inserted into the annular ligament, or into the fascia of the leg above it, or into the plantar fascia. It may have a supernumerary slip attached to the capsule of the joint.

THE POPLITEUS.

The Popliteus muscle arises by a stout tendinous origin from the upper and fore part of the popliteal groove on the external eondyle of the femur. It passes downward and inward, receiving as it does so small fibrous slips from the external semilunar eartilage of the knee-joint, as well as one from the Semimembranosus muscle, and is inserted on the posterior surface of the shaft of the tibia as far as the oblique line, and along the median border of the shaft for the distance of two inches.

Use.—To aid in extending the leg and in fixing the position of the external semilunar cartilage.

Nerve.—The musele is supplied by a branch of the internal popliteal nerve.

The tendon of the Popliteus passes within the knee-joint, and is enveloped by synovial membrane. Beneath the tendon lies a bursa which, as a rule, communicates with the joint. The belly is strengthened by an aponeurosis received from the Semimembranosus.—Some of the muscular fibres (arcuate fibres) are inserted into the posterior capsule of the knee-joint.—The popliteal groove is lined with cartilage, and is continuous with the synovial membrane, thus forming a part

of the articulation of the knee. As long as the limb is extended, the tendon of the Popliteus is not in the groove; but as the knee bends, the tendon slides over the smooth lip of the groove, and should the flexion continue to a considerable degree, the tendon at last slips into the groove, which may thus be said to have been formed for the occasional reception of the tendon of the Popliteus (Winslow).[1]

Variations.—The muscle may have a second head.[2] A sesamoid bone has been found in the tendon. The Semimembranosus may send slips of insertion to the fascia over the muscle.

THE FLEXOR LONGUS DIGITORUM.

The Flexor Longus Digitorum muscle arises from the oblique line and the posterior surface of the tibia from its middle third to within a short distance of the ankle, as well as from a fibrous septum between it and the Tibialis Posticus muscle. At the distal third of the leg the muscle forms a tendon which reaches to the inner side of the ankle, where it lies on the astragalus and the calcaneum, and, passing to the sole of the foot, divides into four tendons, which are inserted into the terminal phalanges of the four outer toes, piercing for this purpose the tendons of the Flexor Brevis Digitorum.

Use.—To flex the four outer toes.

Nerve.—It is supplied by a branch of the posterior tibial nerve.

The tendon lies in a distinct sheath, and is protected at the ankle by the stout annular ligament. Hyrtl describes this muscle as two-headed; the *long* head being that given above as the one for the entire muscle; the *short* head being the Flexor Accessorius.

Relations.—In the leg the muscle lies on the same plane as that of the Tibialis Posticus and the Flexor Longus Pollicis, and, like them, is covered to near the ankle by a layer of the deep fascia. At the ankle the tendon is in close association with the tendon of the Tibialis Posticus, but while it slightly overlies this tendon to the inner side, it is in a distinct sheath. In the sole of the foot the tendon passes beneath the Abductor Pollicis and the Flexor Brevis Digitorum, and lies at the median edge of the Flexor Accessorius in company with the tendon of the Flexor Longus Pollicis.

Variations.—It may undergo longitudinal cleavage. A second head may arise from the fibula.—It may fuse in part with the Tibialis Posticus or the Flexor Longus Pollicis.

The muscle is slightly separated from the tendon of the Tibialis Posticus in *talipes varus*, and a little below the level of the ankle-joint passes suddenly inward and backward at a right angle to the leg toward the sole of the foot.

[1] See also Knox's edition of Cloquet, and J. Goodsir's Anatomical Works.

[2] Gruber, Müller's Archiv, 1875, 599, fig.

THE FLEXOR ACCESSORIUS.

The Flexor Accessorius is a square muscle arising from the calcaneum by two separate masses—one fleshy and broad, from the median surface of the bone, and one tendinous, from the lateral surface at a point in advance of the external tubercle. It is inserted into the oblique tendon of the Flexor Longus Digitorum.

Use.—To assist the Flexor Longus Digitorum.

Nerve.—It is supplied by the external plantar nerve.

Variations.—The muscle may secure an increased origin from the calcaneum, or a slip of origin from the leg—either from the fibula, the fascia, or from the Soleus or Peroneus Brevis muscles. It varies greatly in its insertion, tending in the main to send slips to the flexor tendons of the third and fifth toes.

THE LUMBRICALES.

The Lumbricales are slender fusiform muscles, four in number, arising from the median side of the tendons of the Flexor Longus Digitorum. They pass forward to the web of the foot, where they turn toward the dorsal surface, and are inserted on the dorsal aponeurosis (or tendon of the Extensor Longus Digitorum) at the distal end of the second phalanx of each of the four outer toes.

Use.—To assist the Extensor Longus Digitorum.

Nerve.—They are supplied by branches of the external plantar nerve.

Variations.—One or more of the muscles may be absent.

THE FLEXOR LONGUS POLLICIS.

The Flexor Longus Pollicis, the strongest muscle of the deep layer, arises from the distal two-thirds of the posterior surface of the fibula (excepting a small portion near the ankle), from the septum between it and the Peroneus Longus and the Peroneus Brevis, and from the posterior surface of the Tibialis Posticus muscle. The stout tendon becomes free near the ankle-joint, and descends to the sole of the foot close to the ankle-joint, and lies deep within the interval between the internal malleolus and the astragalus, the posterior border of which it grooves, and is held close to the side of the calcaneum beneath the *sustentaculum tali*. The tendon in the sole of the foot passes along the median border, and is inserted into the terminal phalanx of the great toe. It constantly sends a slip to one of the tendons of the Flexor Communis Digitorum.

Use.—To flex the great toe. The tendon supports the ankle-joint posteriorly. It suffers contracture in atrophy of the Peroneus Longus.

Nerve.—It is supplied by a branch of the posterior tibial nerve.

The tendon of insertion can be traced within the muscle throughout its entire length as a broad coarse aponeurosis. At the region of the ankle-joint it lies in a distinct sheath.

Relations.—In the leg the muscle lies beneath the narrowing portion of the Soleus and the tendo Achillis. It lies upon the fibula and the Tibialis Posticus muscle. To the median side is the Flexor Communis Digitorum, and to the lateral the septum between it and the Peronei.

In the interval between the inner malleolus and the calcaneum, the tendons of the Tibialis Posticus, of the Flexor Communis Digitorum, and of the Flexor Longus Pollicis lie in close relation. The tendon of the Tibialis Posticus lies directly behind the inner malleolus; that of the Flexor Longus Pollicis (more deeply marked) near the astragalus, which it grooves at the posterior border; and that of the Flexor Communis Digitorum lies superficially between these two. The Flexor Longus Pollicis crosses the tendon of the Flexor Communis Digitorum at an acute angle to the median side of and beneath the Flexor Accessorius and Flexor Brevis Digitorum, and at its insertion lies between the sesamoid bones at the first metatarso-phalangeal joint.

In *talipes varus* the tendon does not run through the groove on the back part of the astragalus, and thence under the *sustentaculum tali*, but goes direct to the sole of the foot.

Variations.—The muscle, at its origin, is subject to few variations. It may be regarded as a derivative from the Flexor Longus Digitorum; from which, indeed, it is rarely entirely separated. As mentioned above, it is associated in its insertion with the same muscle, by sending a slip to the second toe in common with it. At times this slip is extended to one or more of the remaining toes. An attempt at longitudinal cleavage is rarely noted, the tendon being inserted, undivided, into the calcaneum. The tendon may send a fibrous slip to the Flexor Accessorius.

THE TIBIALIS POSTICUS.

The Tibialis Posticus muscle arises from that portion of the posterior surface of the fibula, from the tibio-fibular articulation to the middle of that bone, extending from the tibia at the margin of the interosseous membrane, from the entire posterior surface of the membrane itself, and from the septa between it and the other muscles of its group. The muscle forms a broad stout tendon at about the lower fifth of the leg, which lies at first in a groove on the tibia above the inner malleolus, then winds round the malleolus, and is inserted into the tuberosity of the scaphoid bone.

Use.—To extend the foot and to slightly adduct it. It is the chief factor in drawing the scaphoid bone inward and upward in *talipes varus*, and is assisted by the Tibialis Anticus and the Extensor Proprius Pollicis. The tendon supports the internal lateral ligament and the inferior calcaneo-scaphoid ligaments. It is active in the act of climbing.

Nerves.—It is supplied by a branch of the posterior tibial nerve.

The muscle is obscurely bipenniform in appearance, the concealed tendon passing nearly the entire length of the muscle. The tendon sends a stout fibrous slip backward to the calcaneum at the sustentaculum tali.

Relations.—At the proximal portion the muscle is beneath the lower border of the Popliteus. In the calf it lies beneath the Soleus. Between the tibial and fibular origins the posterior tibial artery and nerve pass down the leg. Anteriorly the muscle lies on the interosseous membrane. To the inner side is the Flexor Longus Digitorum, and to the outer the Flexor Longus Pollicis.

The tendon, at the ankle, lies nearest to the bone, and comes well up in relief in adduction of the foot. It lies close to and parallel with the inner edge of the tibia, so that this edge is the best guide to it. Therefore in tenotomy the knife is introduced perpendicularly between the tendon and the bone.

Variations.—It may be in part fused with the Flexor Longus Digitorum. It may send slips of insertion into the bases of all the toes. The occasional slip to the internal cuneiform bone may be blended with the Flexor Brevis Pollicis. A nodule of fibro-cartilage found in the tendon at the internal malleolus sometimes becomes ossified. A tendinous slip may be tributary to the tendon of the Peroneus Longus. The muscle may be absent.—A nodule of fibro-cartilages (sometimes bony) is often found in the tendon as it winds round the malleolus.

Remarks.—In *talipes varus* the tendon of the Tibialis Posticus pursues a nearly straight course downward, and near its insertion is slightly inclined backward, and is thus less closely held to the inner malleolus than is the case in the normally constructed foot.—The muscle is pushed backward or is torn in lateral dislocation of the astragalus.[1]

In a case recorded by Mr. Stanley,[2] the bursa underlying the tendo Achillis became the seat of inflammatory thickening and distension. The skin sloughed, and an ulcer developed which extended down into the sole of the foot and exposed the common sheath of the Tibialis Posticus and the Flexor Longus Digitorum.

[1] Paul Broca, Mém. Soc. Chir., iii. Paris, 1853.

[2] Med. Times and Gazette, July 13, 1880.

The Muscles of the Sole of the Foot.

The muscles of the sole of the foot are divided, for convenience in dissecting, into four layers.

The muscles of the first layer include—

The Flexor Brevis Digitorum.
The Abductor Pollicis Pedis.
The Abductor Minimi Digiti.

THE FLEXOR BREVIS DIGITORUM.

This muscle arises from the inner tuberosity of the calcaneum, from the plantar fascia near this origin, and from the intermuscular septa on either side. It passes forward and divides beneath the metatarsus into four small rounded tendons, which are pierced by the tendons of the Flexor Longus Digitorum, and are inserted into the second phalanges of the four outer toes.

Use.—To flex the toes.

Nerve.—The muscle is supplied by branches of the internal plantar nerve.

Variations.—But three tendons may be present, the fifth toe being without connection with the muscle. The muscle may secure a slip from the tibia. It may arise from both calcaneal tuberosities and from the space between them.

THE ABDUCTOR POLLICIS PEDIS.

The Abductor Pollicis Pedis muscle arises from the tubercle on the median surface of the calcaneum, from the annular ligament, and from a tendinous arch overlying the plantar vessels and nerves. It passes forward along the inner border of the foot, the tendon becoming free at the metatarso-phalangeal joint, and is inserted on the first phalanx of the first toe and on the inner sesamoid bone.

Use.—To abduct the first toe.

Nerve.—The muscle is supplied by a branch of the internal plantar nerve.

Variations.—It may send a slip to the first phalanx of the second toe, or to the skin of the ball of the first toe.

ABDUCTOR MINIMI DIGITI.

This muscle arises from the under surface of the calcaneum at and between the tuberosities, and from the plantar fascia and the external intermuscular septum. It passes forward along the lateral margin of the foot, and is inserted into the lateral surface of the proximal end of the first phalanx of the fifth toe.

Use.—To abduct the fifth toe. It acts as a cushion to the median border of the sole.

Nerve.—The muscle is supplied by the external plantar nerve.

Variations.—The muscle is often described as connected with a slip of the plantar fascia extending from the calcaneum to the fifth metatarsal bone. A variable slip is often inserted into the fifth metatarsal bone. It may fuse with the Flexor Brevis Pollicis and the Adductor Pollicis. The Abductor Pollicis and Adductor Pollicis with the Flexor Brevis Pollicis may be regarded as homologous with the parts of a metatarso-phalangeal flexor of the mammalian foot.

The muscles of the second layer include—

The Flexor Accessorius.
The Lumbricales.

For accounts of these muscles see page 317.

The muscles of the third layer include—

The Flexor Brevis Pollicis Pedis.
The Adductor Pollicis.
The Transversalis Pedis.
The Flexor Minimi Digiti.

THE FLEXOR BREVIS POLLICIS PEDIS.

This muscle arises by two obscurely defined heads: one from the plantar surface of the first cuneiform bone, from the calcaneum, from the sheath of the Flexor Longus Digitorum, and from the adjacent fibrous tissue; and the other from the cuboid and third cuneiform bones. The fascicle of the inner head passes forward parallel with the tendon of the Abductor Pollicis, and is inserted into the inner sesamoid bone at the first metatarso-phalangeal joint. The fascicles of the outer head are inserted into the outer sesamoid bone in company with the tendon of the Transversalis.

Use.—To flex the first toe.

Nerve.—The muscle is supplied by the internal plantar nerve.

Variations.—The inner head often receives a slip from the Tibialis Posticus. It may fuse in part with the Abductor Pollicis and the Adductor Pollicis.

The Flexor Brevis Pollicis is a survivor of a group of metatarso-phalangeal flexors almost constantly present in the mammalian foot.

THE ADDUCTOR POLLICIS

muscle arises from the plantar aspect of the cuboid and of the third cuneiform bones, from the proximal ends of the third and fourth metatarsal bones, and from the sheath of the Peroneus Longus muscle. It passes forward and inward, and is inserted on the outer sesamoid bone at the first metatarso-phalangeal joint.

Use.—To adduct and flex the first toe.

Nerve.—The muscle is supplied by the deep branch of the external plantar.

Variations.—It may send a slip to the base of the first phalanx of the second toe. It may fuse in part with the outer head of the Flexor Brevis Digitorum and the Flexor Brevis Pollicis.—Under the head of Opponens Hallucis some anatomical writers include a frequent variation of the Adductor. It is inserted into the metatarsal bone of the first toe.

THE TRANSVERSALIS PEDIS.

This muscle is closely allied to the foregoing. It arises by separate slips from the capsules of the metatarso-phalangeal joints and the associated fibrous tissues. It passes toward the median border of the foot, and is inserted into the fascia on the outer side of the lateral sesamoid bone over the Adductor Pollicis. It lies directly beneath the tendons of the Lumbricales.

Use.—To assist in adducting the first toe.

Nerve.—The muscle is supplied by the deep branch of the external plantar.

THE FLEXOR MINIMI DIGITI.

This muscle arises from the sheath of the Peroneus Longus and the base of the fifth metatarsal bone, and is inserted into the under surface of the metatarso-phalangeal joint of the fifth toe.

Use.—To indirectly flex the fifth toe by making traction on the plantar portion of the capsule of the fifth metatarso-phalangeal joint.

Nerve.—The muscle receives a branch from the superficial branch of the external plantar nerve.

Variations.—It may send a slip to the base of the first phalanx of the fifth toe, or to the lateral aspect of the joint. The muscle is a rudiment of the fifth Metatarso-Phalangeal Flexor of quadrupeds.

The muscles of the fourth layer include—
The Interossei.

THE INTEROSSEI.

These muscles are composed of the dorsal and the plantar set. Each consists of a single belly and a distinct tendon, which is inserted into the dorsal aponeurosis of the phalanges at the metatarso-phalangeal joint.

The Dorsal Interossei, four in number, are arranged as follows: Each muscle, excepting the first, arises from the opposed sides of the interosseous space, within which it is lodged, and on a level with the dorsum of the foot.

The *first* arises from the borders of the first interosseous space, and is inserted into the extensor tendon and the base of the first phalanx.

The *second* arises from the second interosseous space, and is inserted into the first phalanx of the second toe on its lateral surface.

The *third* arises from the third interosseous space, and is inserted into the first phalanx of the third toe on its outer border.

The *fourth* arises from the fourth interosseous space, and is inserted into the first phalanx of the fourth toe on its outer border.

Use.—The outer three muscles are abductors of the second, third, and fourth toes respectively, while the first is an adductor of the second toe, and assists the Plantar Interossei.

The Plantar Interossei, three in number, are small muscles, each a single, slender, fusiform mass, lying on a level with the plantar surface of the foot, and lodged in the interosseous spaces, but not, as in the case of the dorsal muscles, entirely occupying them.

The muscles are arranged as follows: They are placed on the median side of the lower surface of the third, fourth, and fifth metacarpal bones, respectively, and are inserted into the dorsal aponeurosis of the corresponding metacarpo-phalangeal articulation at the median margin.

Use.—To flex the first phalanx and extend the second and third phalanges. In addition they adduct the toes upon which they are inserted.

Nerves.—The nerves of both groups of Interossei are supplied by the deep branch of the external plantar.

Geo. Ruge,[1] who has studied the development of the intrinsic muscles of the foot, has arrived at the conclusion that the muscles were all originally plantar, and that the Dorsal Interossei are the results of advanced specialization by which plantar slips are pushed through the intermetatarsal spaces, and ap-

[1] Morph. Jahresbr. iv. 1878, 117, supplement.

EXPLANATION OF PLATE LVI.

Fig. 1. The plantar fascia.

Fig. 2. The superficial muscles (first layer) of the sole of the foot.

Fig. 3. The second layer of muscles of the sole of the foot.

PLATE LVI

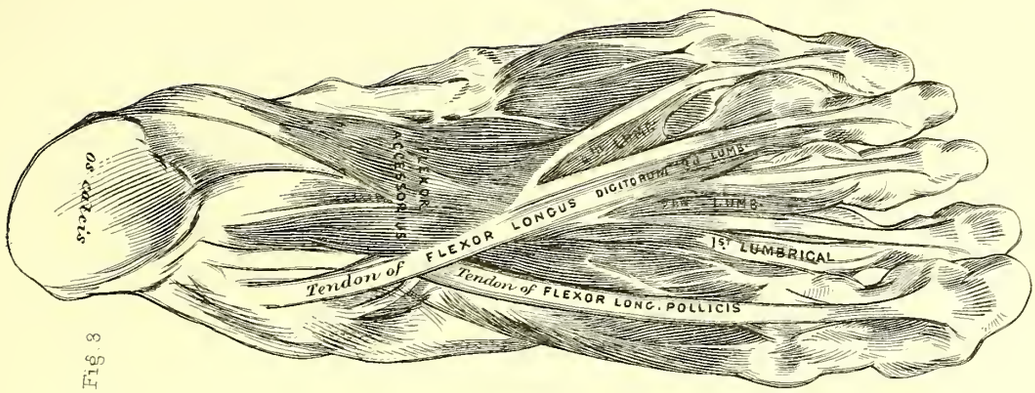


Fig 3

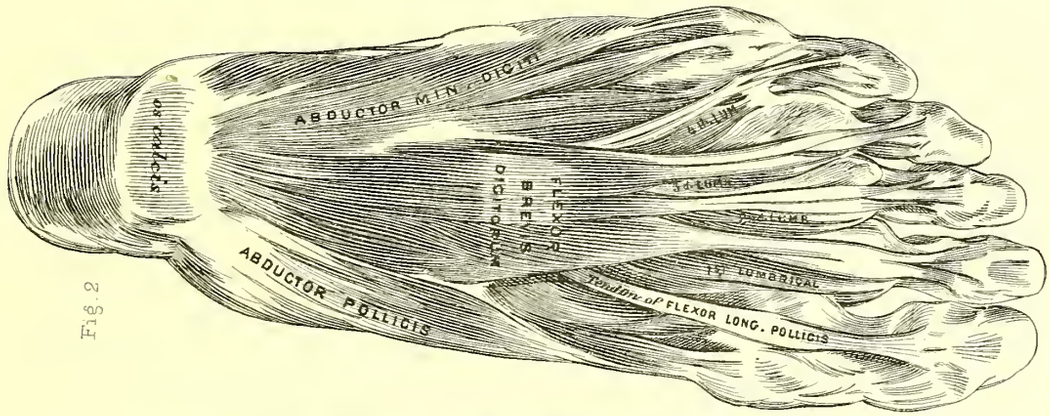


Fig 2

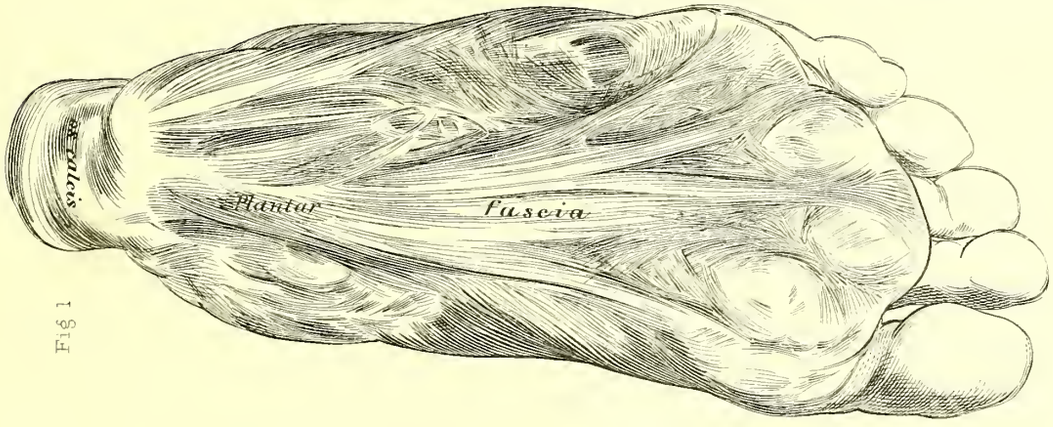


Fig 1

T. Sinclair & Son, Lith.

pear in time on the dorsal surface of the metatarsus. The dorsal muscles are thus seen to be of less importance than the flexors, and may be absent or imperfectly differentiated.

D. L. Cunningham[1] divides the interosseous muscles of the foot into the plantars or adductors, the dorsals or abductors, and the intermediate group or the flexors.

The Deep Fasciæ of the Lower Extremity.

The Deep Fascia of the Thigh.—The plan of arrangement of the fascia of the thigh is best understood by bearing in mind the important relations existing between the trunk and the lower extremity. These are quite different from those existing between the trunk and the upper extremity. In the former the aponeurosis of the muscular abdominal wall and the sub-peritoneal connective tissue are continuous with the fasciæ of the limb. In the latter the aponeurotic extension from the chest-wall does not involve any important muscular action, nor is it anywhere of special strength; and the thoracic region in no way contributes to the formation of the brachial fascia.

The fasciæ of the thigh are derived from three sources: (1) the back; (2) the anterior wall of the abdomen; and (3) the interior of the abdomen.

(1) *The Fascia Derived from the Back.*—The Gluteus Maximus muscle is covered by a thick layer of firm adipose tissue, and the muscle itself is intimately incorporated with a fibrous sheath. The Gluteus Medius muscle is covered by a well-defined layer of fascia, which is in common with that of the Tensor Vaginæ Femoris. The lower portion of the Gluteus Maximus yields an important accession to this system of fasciæ, and contributes to form the thick and important aponeurosis of the outer side of the thigh, which has received the name of the fascia lata. Posteriorly the *fascia lata* is attached to the outer lip of the linea aspera, and to the intermuscular septa of the posterior femoral group of muscles. The Vastus Externus receives accessions from it in front, and the short head of the Biceps Flexor behind. Inferiorly the fascia forms a rounded cord lying directly beneath the skin above the outer femoral condyle. Some writers trace the fascia lata to the head of the fibula; and consider such fibres as can be traced in a straight line to the Tensor Vaginæ Femoris as functionally the tendinous fibres of insertion of that muscle. Whether the innovation be adopted or not, it is of value to insist upon the functional relation existing between the Tensor Vaginæ Femoris and other muscles of the same group which are inserted, in part, at least, upon the fascia lata. The fascia lata may be defined as that part of the femoral aponeurosis which can be influenced by the action of the muscles of the gluteal group.

Anteriorly the fascia lata divides at the posterior border of the Sartorius muscle, one layer passing in front, the other behind. Upon the inner (median) border of the muscle, the fascia, although often denominated the fascia lata, will in this connection be designated as the *sartorial fascia.*

Pus or blood under the fascia lata develops a well-defined group of characters. As a result of spontaneous rupture of a femoral aneurism, the blood spreads rapidly in the cellular interspaces of the thigh, and causes the integument from the groin to the knee to swell uniformly and to present the superficial appearances of a deep abscess. Such a collection has at times been opened by incautious surgeons, with the unexpected result of fluid arterial blood escaping from the puncture instead of pus. Richet,[1] who dissected the thigh of a subject in which the condition described above had been detected during life (the external iliac artery having been secured), found that the blood had not only infiltrated the muscular interspaces and the cellular tissue, but even the muscular substance itself; yet, in spite of the enormous pressure which had been brought to bear to effect such a result, the fascial covering of the thigh remained intact.

Mr. John Adams[2] records an example of a femoral hernia descending beneath the fascia lata over the Pectineus muscle, behind the sheath of the femoral vessels, but to the inner side of the vein.

The muscles inserted on the fascia lata may slightly extend the leg after fracture of the patella.[3]

(2) *The Fascia Derived from the Anterior Wall of the Abdomen.*—The *sartorial fascia* is the same as the iliac portion of the fascia lata of authors. It is derived from the anterior wall of the abdomen, and is continuous with the aponeurosis of the External Oblique muscle at the front of the thigh. In passing to the groin, it forms Poupart's ligament, and below this structure it is continuous with the fascia lata at the Sartorius muscle.

This layer of fascia might be compared to an apron attached above at the aponeurosis of the External

[1] Traité Prat. d'Anat. 1869, 982.

[2] Med.-Chir. Trans. xliii 127.

[3] W. W. Keen, Annals of Anat. and Surg., Jan. 1881.

Oblique, and hanging downward over the groin. It differs from most of the deep fasciæ of the body in being intimately connected with the superficial fascia, and in being itself freely divisible. In a word, it is of a relatively loose texture, and readily permits of lamellar division by dissection, perforation by vessels, and the lodgment of fat and lymphatic glands. Inferiorly, it is gradually lost upon the Sartorius and Gracilis muscles, besides giving accessions to the femoral sheath and intermuscular septa, while to the inner (median) side it is continuous with a deeper layer of fascia known as the *pectineal* fascia.[1]

(3) *The fascia derived from the interior of the abdomen.*—The layer derived from the interior of the abdomen consists of the subperitoneal connective tissue. The transversalis fascia is derived from the parietal layer of the abdomen, and serves to strengthen the previous layer. It is for the most part inserted at the line of Poupart's ligament, although the anterior surface of the femoral vessels receives an important accession from its inner (median) portion. The last-mentioned membrane is sometimes called the *deep crural arch.*—The *pectineal fascia* is the same as the pubic portion of the fascia lata of authors. It is derived from the iliac fossa, and, passing out of the pelvis at the crural arch, forms the posterior wall of the femoral sheath, and is continuous, over the Pectineus muscle, with the fibrous sheaths of the muscles at the inner side of the thigh. Here it is lost in the general fibrous sheaths and septa at the lower part of the thigh, becoming continuous with the fascia lata posteriorly, and with the sartorial fascia anteriorly.

For details of this and the preceding portion see Surgical Anatomy of Femoral Hernia.

The Deep Fascia of the Leg.—The deep fascia of the leg forms a uniform covering for the muscles, and, indeed, for the entire leg excepting the subcutaneous inner (median) surface of the tibia.

The posterior portion of this fascia is divided into a superficial and a deep division: the former embraces the Gastrocnemius, the Soleus, and the Plantaris; the latter forms a well-defined transverse membrane which stretches across parallel to the plane of the tibia and fibula, and which covers in the posterior part of the Tibialis Posticus, the Flexor Longus Digitorum, and the Flexor Longus Pollicis, with the posterior tibial vessels and nerve.

The fascia of the inner aspect of the leg, in addition to affording sheaths to the several muscles, yields partial origin to the Tibialis Anticus and the Extensor Communis Digitorum. Pronounced septa extend between the peroneal and anterior tibial groups of muscles on the one hand, and between the peroneal and posterior tibial groups on the other.

The fascia of the leg is made tense by the muscles of the thigh. The Semimembranosus affects the posterior portion over the inner head of the Gastrocnemius; the Gracilis, the fascia over the belly of the Gastrocnemius; the Semitendinosus and the Sartorius, the fascia over the front of the leg; and the Biceps Flexor Femoris that over the fibula and adjacent parts.

The Plantar Fascia.—The plantar fascia is a thick layer of fibrous tissue occupying the sole of the foot between the skin and subcutaneous fat and the first layer of muscles. It is divided into three portions, the inner, middle, and outer.

The *inner portion* lies over the Abductor Pollicis muscle. Posteriorly it forms an arch extending from the inner malleolus to the calcaneum, behind which pass the plantar vessels.

The *middle* or *main portion* lies over the short flexor of the toes. At its origin from the under aspect of the calcaneum it is tense and of uniform thickness. As it passes forward it becomes weaker, and finally splits up into five slender divisions, one for each of the toes. It also sends fasciculi of support to the metatarso-phalangeal joints, and strengthens the fibres connecting them.

The *outer portion* is less uniform than the others. In addition to covering in the Abductor Minimi Digiti and the Flexor Minimi Digiti, and being inserted upon the distal end of the fifth metatarsal bone, it sends a stout slip from the calcaneum to the base of the fifth metatarsal bone.

The following is a list of the superficial bursæ of the inferior extremity: one over the trochanter major;

[1] For a special study of the fascia lata, see H. Welcker, Archiv für Anat. und Physiologie, 1876, fig.

EXPLANATION OF PLATE LVII.

Fig. 1. The third layer of muscles of the sole of the foot.
Fig. 2. The interossei muscles of the foot, seen from below.
Fig. 3. The interossei muscles of the foot, seen from above.

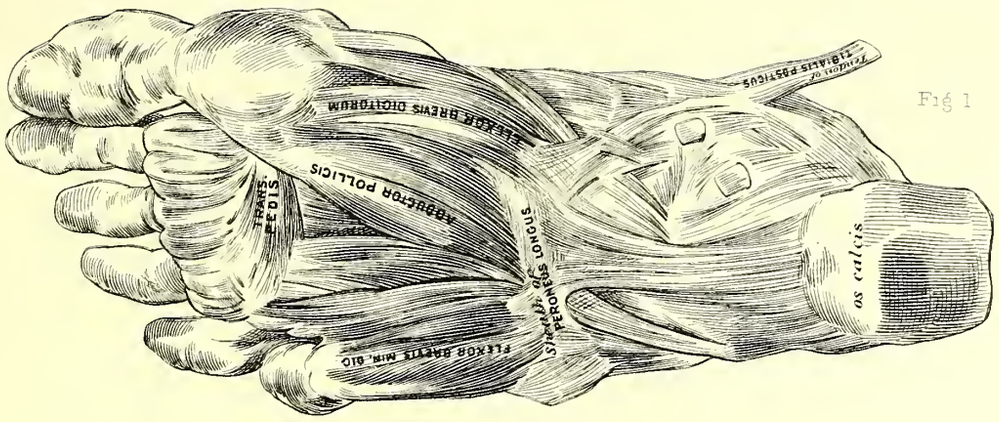


Fig 1

Fig. 2

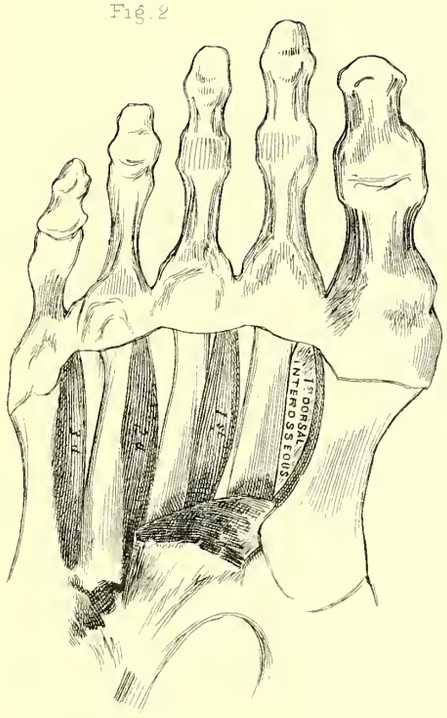
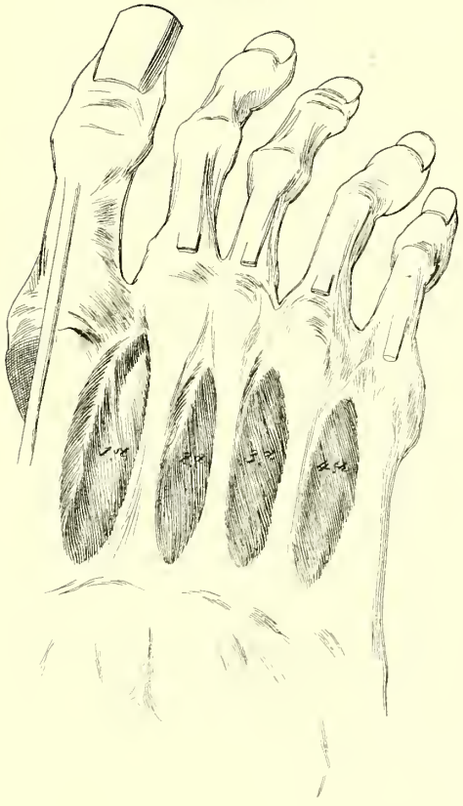


Fig 3



Donclan & Son, Lith.

one over the tuberosity of the ischium; a patellar bursa; three in the popliteal space, an internal, external, and median (in connection with which Coulson narrates an instance of a female, aged thirty-two, in whom a bursal tumor containing an ounce and a half of fluid formed in the middle of the popliteal space); one over each malleolus, that over the external being the larger; and one over the distal end of the first metatarsal bone.

The Anatomy of the Parts Involved in Inguinal and in Femoral Hernia.

(a) inguinal hernia.

Since much of the interest of the study of fascia pertains to hernia, the varieties of this lesion will be here discussed, and the structural features in connection therewith be given in the order of their importance. By *inguinal hernia* is meant a protrusion of some of the contents of the abdominal cavity along the path already selected in the male by the testis in its descent from the abdomen, or in the position of the round ligament in the female. Ordinarily a loop of the small intestine constitutes the hernia. The cæcum and a portion of the omentum may also be engaged. Other contents of a hernial protrusion are so rare that they need not here be mentioned. The anatomy of inguinal hernia will be described as occurring in the male.

In the descent of the testicle a part of the peritoneum is carried therewith to the bottom of the scrotum. In normal development the lower part of this extension of the peritoneum forms the *tunica vaginalis*, while the connection between it and the peritoneal cavity disappears. If it should not disappear, but remain open, opportunity is afforded for loops of intestine to descend as far as the testis. This constitutes *congenital inguinal hernia*. If the sac of such a hernia is improperly formed, and the peritoneal canal simply narrowed but not obliterated, the hernia occurring therein is called *infantile*. It is evident, however, that this condition is simply a variety of congenital hernia.

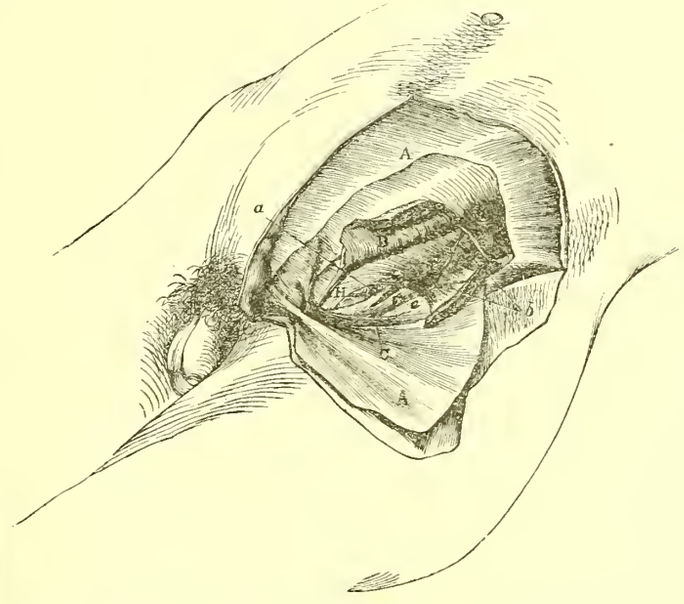
Hernia occurring under circumstances other than those mentioned above is called *acquired*.

The coverings of hernia will be described from within outward.

An examination of the inner surface of the anterior wall of the abdomen above the groin in a subject whose arteries have been injected will show two shallow depressions of the peritoneum immediately above Poupart's ligament. Between them extends a vertical or nearly vertical elevation which corresponds to the position of the deep epigastric artery. These depressions are intimately concerned in the mechanism of inguinal hernia. If the loop of intestine carries the *outer* (lateral) depression or pouch in front of it, it forms what is known as *indirect inguinal hernia;* if it carries the *inner* (median) depression in front of it, it forms *direct inguinal hernia.*

Indirect Inguinal Hernia.—A protrusion of intestine through the outer pouch pushes before it first the peritoneum lining the pouch. Beneath the peritoneum lies the sub-peritoneal connective tissue or transversalis fascia. The loop thus covered pushes its way through the internal abdominal ring into the inguinal canal, and, inasmuch as this ring is occupied by connective tissue known as the *infundibuliform fascia*, the hernia acquires a third layer. If the protrusion goes no further, the lesion constitutes *incomplete* inguinal hernia, and possesses as additional coverings—the tendon of the external oblique abdominal muscle, the superficial fascia, and the integument. Ordinarily, however, it descends the entire length of the inguinal canal in company with the spermatic cord, which lies to its inner (median) side, and escapes at the external abdominal ring, where it constitutes *complete* inguinal hernia, and loses the external abdominal muscle as a covering. An old neglected complete inguinal hernia is apt to gravitate into the scrotum, where it will add the scrotal tissues to its

Fig. 78.



View of the Parts Concerned in Inguinal Hernia.—A External oblique tendon, thrown down. B. Internal oblique, the lower part raised. C. Cremaster muscle in its natural position D. Transversalis muscle with a free border. F. Spermatic cord. G. Fascia transversalis. H. Conjoined tendon. *a*. Epigastric vessels. *b*. Branch of the circumflex iliac artery.

coverings, including the Cremaster muscle which is composed of a few of the lower fibres of the Internal Oblique muscle which have been carried downward in the descent of the testicle.

Accordingly, in cutting down upon a complete indirect inguinal hernia, the following structures are met with in the order named:—

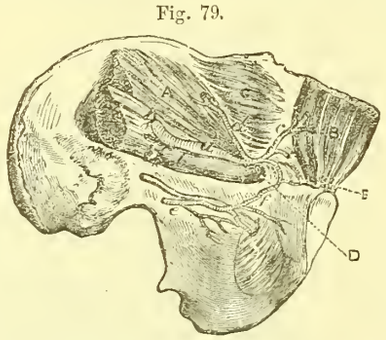
Skin, subcutaneous or superficial fascia, Cremaster muscle, infundibuliform fascia, transversalis fascia, and the peritoneum. The structure last named is called the sac of the hernia, and usually contains a moderate quantity of serous fluid.

When a hernia can be replaced at will in the abdomen it is said to be *reducible*, and when it cannot be replaced, *irreducible*. *Irreducible* or *incarcerated hernia* may in turn become strangulated, when, the bloodvessels of the loop of intestine being compressed, the integrity of the parts is seriously threatened.

The point of constriction of a strangulated inguinal hernia is ordinarily at the neck of the sac, that is, at the point where the sac is held at the internal abdominal ring.

Direct Inguinal Hernia.—Should the pressure against the abdominal walls cause the loop of intestine to protrude within the inner pouch or depression (known also as the triangle of Hasselbach), the lesion termed *direct inguinal hernia* is initiated. The loop in

Fig. 79.



View of the Parts Concerned in Femoral Hernia.—A. Iliacus covered by the iliac fascia. B. Rectus. C. Transversalis covered by the transversalis fascia. D. Crural ring. E. Gimbernat's ligament. *a*. Iliac artery. *b*. Iliac vein. *c*. Epigastric branch of external iliac. *d*. Circumflex iliac *e*. Obturator artery, with its nerve. *f*. Small branch joining the obturator and epigastric arteries.

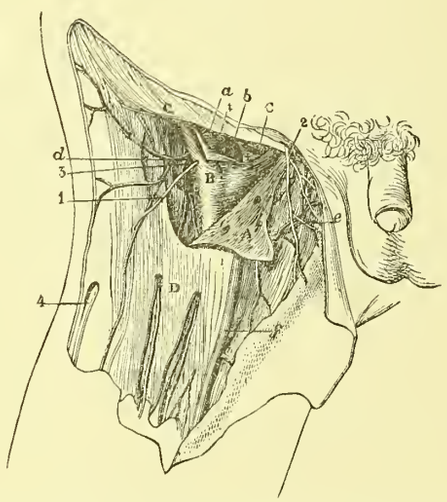
this variety carries before it the peritoneum and the transversalis fascia as in the indirect form. The hernia next pushes before it the conjoined tendon of the Internal Oblique and Transversalis muscles, and presents itself at the external abdominal ring, through which it protrudes. It now secures additional coverings of superficial fascia and skin, and lies above and to the outer side of the spermatic cord. Prof. D. H. Agnew doubts that this hernia ever retains the conjoined tendon as a covering. In his judgment the loop escapes to the outer side of the conjoined tendon.

Proceeding from without inward the coverings of a direct inguinal hernia are as follows: skin, superficial fascia, conjoined tendon (?), transversalis fascia, and peritoneum (sac). In both varieties of inguinal hernia it is important to remember the position of the deep epigastric artery. In the *indirect* the artery lies to the *inner* side of the neck of the sac; in the *direct* it lies to the *outer* side.

(b) FEMORAL HERNIA.

In this variety of hernia the loop of intestine escapes to the inner side of the track prepared for the accommodation of the femoral vessels. As in the previous examples, the loop of intestine pushes before it a layer of peritoneum and of subperitoneal connective tissue. The subperitoneal connective tissue just mentioned is often called the *septum crurale*, by reason of its position. The *femoral ring* lies to the inner (median) side of the femoral vein. It is defined above by Poupart's ligament below by the linea ilio-pectinea, to the outer

Fig. 80.



View of the Fascia and Associated Parts below Poupart's Ligament.—A. Fascia lata reflected. B. Crural sheath opened. C. Poupart's ligament. D. Fascia lata of the thigh in place. ‡ Two septa dividing the space of the crural sheath into three compartments. *a*. Femoral artery; *b*. Femoral vein; and *c*. A lymphatic gland, all in the crural sheath. *d*. Superficial circumflex iliac artery. *e*. Superficial pudic artery. *f*. Saphenous vein. 1. Genito-crural nerve. 2. Ilio-inguinal nerve. 3. External branch of middle cutaneous nerve. 4. External cutaneous nerve.

side by the femoral vein, and within by a downward expansion of Poupart's ligament known as Gimbernat's ligament. Before advancing further, a knowledge of the relations existing between the abdominal and femoral fasciæ is necessary.

The Crural Arch.—The lower border of the anterior parietes of the abdomen and the upper border of the

anterior femoral region are contiguous at the groin. A line drawn from the anterior superior spinous process of the ilium to the pubis represents the lower border of the abdominal muscles, and the upper border of the femoral fasciæ. By removing the abdominal muscles from about this line, and deflecting them upward, and by removing the femoral fasciæ therefrom and deflecting them downward, there can be felt in position a fibrous cord extending between the ilium and the pubis, which has received the name of *Poupart's ligament* or the *crural arch*. It is of great importance to remember that the cord or ligament has no existence in nature, but is a product of the dissector's art.

The space which intervenes between Poupart's ligament and the innominate bone is often spoken of as the *crural arch* as well as the ligament itself. In the same manner as one can use the terms *arch* and *archway* interchangeably, so one may speak of Poupart's ligament and the space beneath it. Strictly speaking, however, the ligament constitutes the *arch*, and the space beneath the *archway*.

In this sense the crural arch is secured to the pubis by a broad triangular abutment which has received the name of *Gimbernat's ligament*. This abutment differs from Poupart's ligament in receiving few or no fibres from the femoral fasciæ, but all or nearly all from the abdominal muscles. It strengthens the attachments of the External Oblique muscle, is nearly horizontal in the erect subject, and occupies the narrow acute interval between the pubic end of Poupart's ligament and the ilio-pectineal line.

The crural archway is occupied at its outer (lateral) half by the Iliacus Internus and the Psoas Magnus muscles. The external cutaneous nerves escape near the anterior superior spinous process, and the anterior crural nerve between the Iliac and the Psoas muscles. The inner (median) half is occupied by the femoral vessels, the artery lying to the outer side, and the vein to the inner. These structures are included in the *femoral sheath*, which is composed of three compartments—one for the artery, one for the vein, and one occupied by a small quantity of connective tissue (transversalis fascia, crural septum), and by an occasional lymphatic gland. It is along this last compartment that a femoral hernia descends. In technical language, it may be said to lie within the *femoral canal*, which extends from the *femoral ring* at the plane of Poupart's ligament and of Gimbernat's ligament to the *saphenous opening* in the deep femoral fascia. The manner of formation of the femoral canal is much more intricate than that of the inguinal canal, and requires for its comprehension an exact knowledge of the fasciæ of both the abdomen and the thigh.

The Fasciæ of the Thigh in connection with the Anatomy of Femoral Hernia.—It has been said that the femoral ring is bounded externally by the femoral vein. In more exact language, it is bounded by the sheath enclosing this vessel and the femoral artery. What composes this sheath? The external iliac vessels (artery and vein) do not possess a sheath. What are the structures thus seen abruptly investing these vessels at the point of their exit from the trunk, and why the assumption of new names for them? To answer these questions we are compelled to make a careful study of the sub-peritoneal connective tissue. Beneath the parietal (anterior) layer of the peritoneum lies a layer of connective tissue called the *transversalis fascia*. Beneath the visceral (posterior) layer, as applied over the Iliac and Psoas muscles, the connective tissue layer is called the *iliac fascia*. Now the transversalis fascia is lost upon Poupart's ligament throughout its entire length, except where the femoral vessels escape. At this point the transversalis fascia is continuous with and indeed forms the *anterior layer* of the femoral sheath. The *iliac fascia* in its turn, while continuous with Poupart's ligament at its outer (lateral) half, is free from and passes beneath this structure at its inner (median) half. It constitutes the deep layer of the femoral fascia (pectineal fascia) at the same time that it forms the *posterior layer* of the femoral sheath. The median and lateral limits of the sheath are of the nature of *septa*.

The superficial layer of the deep femoral fascia (often spoken of as the iliac portion of the *fascia lata* or the *sartorial fascia*) is continuous above with Poupart's ligament. It covers the femoral vessels and sheath in front, and is continuous with the *pectineal fascia* (pubic fascia, pubic portion of fascia lata) at the *inner* aspect of the thigh. This blending of the two layers, which will henceforth in this description be spoken of as the *sartorial* and the *pectineal fasciæ*, is interrupted at about the position of the femoral vein by an elliptical opening, measuring about an inch and a half in its longest diameter, designed to transmit the long saphenous vein from the plane of the sartorial fascia to the femoral sheath. This interruption constitutes the *saphenous opening*. It is imperfectly defined below, where the two layers of femoral fascia blend insensibly, but is sharply limited above on the plane of the sartorial fascia. This upper trenchant edge is crescentic, and its concavity is directed outward. In surgical language it is called the *falciform* process, or *Hey's ligament*.

Not only does this ligament define the upper and outer lateral borders of the saphenous opening, but it is continuous beneath the pubic attachment of Poupart's ligament with Gimbernat's ligament. The inner (median) border of the saphenous opening is thus on a lower plane than the upper and outer border. It is not sharply defined, but is represented by a smooth layer of pectineal fascia which is traceable upward *beneath* the femoral ring to the iliac fascia of the trunk.

The *femoral* or *crural canal* is thus seen to be a curved passage of intricate outline determined by the relation of the superficial and deep layers of femoral fascia, and by the different planes which these structures necessarily occupy at the region of the groin. The loop of intestine passing along this canal receives no additional covering. When, however, it reaches the saphenous opening, it encounters the general superficial fascia of the thigh, which has here received the distinctive name of the *cribriform fascia* from its sieve-like appearance. From the structural peculiarities of the saphenous opening already noticed, the loop of intestine inclines upward, and is turned abruptly over the sharp edge of Hey's ligament.

The *coverings of femoral hernia* from without inward are, therefore, skin, cribriform fascia, transversalis fascia (crural septum), and peritoneum. Sir Astley Cooper and his followers accept the so-called *fascia propria* as a layer in place of the crural septum. The fascia propria is by these writers said to intervene between the cribriform fascia and the crural septum, and to be derived from the sheath of the femoral vessels.

The *point of constriction* in femoral hernia is commonly at the femoral ring, where either Hey's ligament or Poupart's ligament requires nicking before the constriction is overcome. In attempts at the *reduction of a femoral hernia* it is of importance to remember the flexion of the hernial mass upward over Hey's ligament. The loop must be drawn downward from this position, and brought in the same line with that of the femoral canal before success can be expected. When the thigh is flexed and carried across its fellow, all the fascial expansions at the groin are relaxed. This, therefore, becomes the most favorable position in which the limb can be placed for the reduction of femoral hernia.

A knowledge of the relations of the obturator artery is of importance in the operation for femoral hernia.[1]

[1] For figures of the fascia of the lower extremity the reader is referred to Plate LXXV.

VI. THE MUSCLES AND FASCIÆ OF THE PERINEUM.[1]

The perineum is the region which limits the trunk inferiorly, and is composed of those structures which fill in the inferior strait of the pelvis. Its boundaries are thus the same as those of the pelvic outlet, while its components of necessity vary in the two sexes.—In the *male* the perineum is composed of the anus, and the muscles inserted into it, of the bulb of the spongy body, and of the muscles connected therewith. The skin-surface of the perineum is marked by a conspicuous raphé extending from the anus to the root of the scrotum. The point of junction between a line connecting the tuberosities of the ischium and the raphé is called the *perineal centre*, and serves as a convenient point of comparison in describing the component parts of the perineum.—In the *female* the perineum, as in the male, includes the anus and the muscles inserted into it, but, instead of including any portion of the genitals, ends at the posterior margin of the vulva.

The perineum of the male is divided by the surgeon into two regions by an imaginary transverse line uniting the ischial tuberosities. The region in advance of the line is called the anterior perineum or the perineum proper; the region back of the line is called the posterior perineum.

(*a*) The *anterior* or *true perineum* is the genito-urinary portion of the pelvic outlet. It includes the membranous, muscular, and other structures occupying the sub-pubic arch. The form is that of a triangle whose base is directed backward. It presents two layers, an anterior and a posterior—the two being traversed by the membranous portion of the urethra, bloodvessels, and nerves. Surrounding the urethra within these layers is the Transversus Perinæi Profundus and the Constrictor Urethræ muscles, and imbedded among the fibres of the latter are the glands of Cowper.

From the great interest attached to this region in the operations upon the neck of the bladder and the membranous portion of the urethra, in the male, the true perineum has been elaborately studied as an arti-

[1] In a classification of muscles, p. 246, the muscles of the genital apparatus or the perineum are placed in the fourth or last section, and include the muscles of the anal region and those of the genito-urinary tract.

Those of the third section, viz., the muscles of the larynx, are described under the section treating of that organ. The muscles of the present group may for convenience be considered as a sixth section of the classification presented.

ficial region having boundaries different from those which have been named.

The perineum of surgical anatomy is a triangular plane lying between an imaginary line connecting the ischial tuberosities posteriorly, and the root of the scrotum anteriorly. Laterally it is without exact limitation, unless the position of two imaginary lines passing from the ischial tuberosities to the root of the scrotum can be such, and is continuous with the median surfaces of the thighs.

The gynecologist speaks of the perineum of the female as the superficies lying between the anus and the posterior angle of the vulva. The structures underlying it enter into the composition of the recto-vaginal septum.

(*b*) The *posterior perineum* includes the region of the anus, and the spaces between the rectum and the ischial tuberosities. The first of these is commonly called the *anal region*, and the second the *ischio-rectal fossa* of each side.

The *anal region* may be defined to be the space answering to the embrace of the Sphincter Ani muscle.

The *ischio-rectal fossa* is the space between the Levator Ani muscle and the pelvic fascia covering the Obturator Internus muscle of its own side. It is open beneath, where it communicates with the gluteal region. It is occupied by fat.

1. The Muscles of the Perineum.

(See Plates illustrating the Genito Urinary Organs.)

The muscles of the perineum are divided into a genito-urinary and an anal group.

The Genito-Urinary group embraces—
- The Transversus Perinæi Superficialis.
- The Bulbo-Cavernosus.
- The Ischio-Cavernosus.
- The Transversus Perinæi Profundus.
- The Constrictor Urethræ.

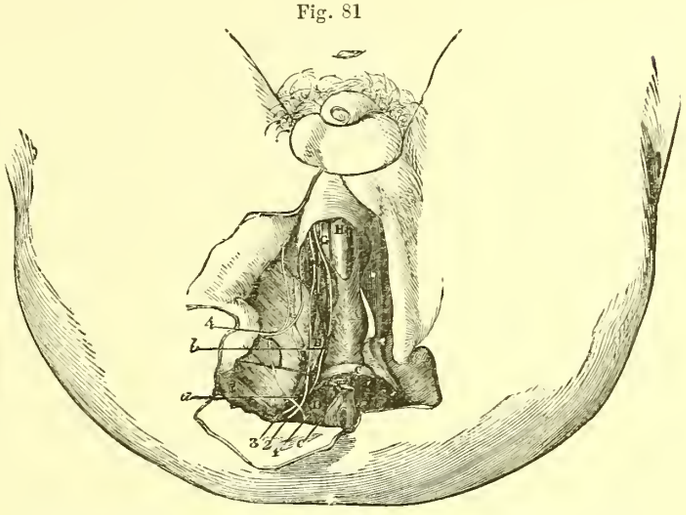
The Anal group embraces—
- The Sphincter Ani.
- The Levator Ani.
- The Ischio-Coccygeus.

THE TRANSVERSUS PERINÆI SUPERFICIALIS MUSCLE.

The Transversus Perinæi Superficialis is a delicate and somewhat inconstant structure. It arises from the inner surface of the pubic arch, and is inserted together with its fellow of the opposite side at the perineal centre. The muscle lies beneath the deep layer of the superficial perineal fascia, and directly in front of the line of its union with the fascia propria. It is sometimes continuous by some of its fibres with the Sphincter Ani.

Function.—Both muscles acting together tend to elevate the perineum. They are both active at the close of defecation (hence the name of Levator Ani Parvus sometimes given them) and of parturition. In the male they assist in the expulsion of semen by the elevation of the perineal tissues against the prostate gland and the bulb of the spongy body.

Fig. 81



A. Bulbo-cavernosus muscle. B. Ischio-cavernosus muscle. C. Transversus perinæi superficialis. D. Levator ani. E. Gluteus maximus. G. Crus penis. H. Urethra. *a*. Transverse perineal artery. *b*. Superficial perineal artery. *c*. Branch of sciatic artery. 1. Inferior hæmorrhoidal nerve. 2, 3. Superficial perineal nerve. 4. Inferior pudendal nerve.

THE BULBO-CAVERNOSUS MUSCLE.

The Bulbo-Cavernosus muscle (Bulbo-Urethralis, Accelerator Urinæ, Ejaculator Seminis) surrounds the bulb of the urethra apparently as a single muscle, which is found on careful inspection to be divided by a raphé into two muscles. Each lateral portion or muscle arises not only from the raphé but from the perineal centre. It passes thence forward and outward by oblique fibres, and is inserted posteriorly into the triangular ligament, and anteriorly (by ascending between the crus and the bulb of the urethra) it is inserted upon the back of the spongy body. A few variable slips reach the dorsum of the penis where they are continuous with the aponeurosis of that organ.

Function.—In the unerected penis the muscle assists in voluntarily expelling the urine from the urethra at the end of micturition. In the erected organ it aids in maintaining the erected state chiefly by the compression of the veins of the bulb, and less constantly by the tension of the aponeurosis of the

dorsum of the penis, thereby compressing the dorsal veins. It also involuntarily expels the semen left in the urethra at the close of coition.

Remarks.—The description of the muscle as given is based upon a dissection made from below, that is from the perineum. It is in every way probable that a reversal of the description would be more appropriate. Fibres arising from the triangular ligament and the dorsum of the cavernous body, *inserted* upon the raphé, would be well adapted to compress the bulb, while no motion could ensue from fibres inserted on a fixed structure like the triangular ligament.

THE ISCHIO-CAVERNOSUS MUSCLE.

The Ischio-Cavernosus muscle (Erector Penis) arises from the median aspect of the ascending ramus of the ischium, immediately in advance of the tuberosity, and in close association with the crus of the penis. It passes forward and is inserted upon the outer side of the cavernous body. An inconstant slip passes upward to meet its fellow of the opposite side at the median line of the dorsum of the penis.

Function.—In the unerected penis the muscle retracts the root of the penis. In the erected organ, it aids in maintaining erection. It is doubtful whether this muscle in any way initiates erection. In the female a muscle analogous to the foregoing (Ischio-Clitoridis) arises from the ischium and is inserted upon the clitoris.

THE TRANSVERSUS PERINEI PROFUNDUS.

This muscle occupies the base of the triangle between the tuberosity of the ischium and the Bulbo-Cavernosus muscle. It arises from the side of the descending ramus of the pubis as a loosely fasciculated layer, whose fibres are inserted some over and some under the membranous portion of the urethra, embracing the glands of Cowper.

Function.—This muscle aids the Bulbo-Cavernosus.

THE CONSTRICTOR URETHRÆ.

The Constrictor Urethræ muscle surrounds the urethra more intimately than does the preceding. It arises from the layer of fascia extending between the pubis and the prostate gland, known as the pubo-prostatic ligament. The fibres split into an anterior and a posterior set inclosing the urethra between them.

A delicate fascicle passing from the posterior surface of the pubis to the neck of the bladder has received the name of the Pubo-Vesical muscle.

Both of the above-named muscles are considered by Luschka to be parts of a single muscle which he describes under the name of Musculus Urethralis Transversus.

Function.—The muscles act together in compressing the urethra, and thus assist the action of the Bulbo-Cavernosus. They resist the sudden introduction of a catheter.

M. Cadiat,[1] as a result of an elaborate study of the muscles of the perineum, states that the so-called muscles of Wilson and Guthrie are best included within a muscular layer which permits of the following description. There exists in the perineum between the anal sphincter and the circular fibres about the urethra (included here in the two muscles last described) an arrangement of imperfectly specialized transverse muscular fibres of variable form. These fibres are in part inserted into the raphé, in part are continuous with the Bulbo-Cavernosus muscle, and in part serve as subdermal fasciculi, and like such fibres are not properly described from the standpoints of origin or insertion, but are related to the different bands of connective tissue. None of the fibres exert any action upon the venous circulation.

THE SPHINCTER ANI.

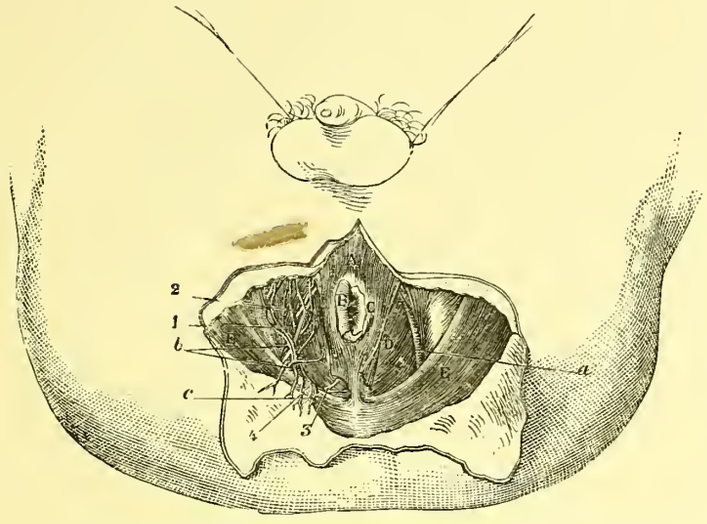
The Sphincter Ani muscle (External Sphincter, see illustrations of the genito-urinary apparatus) arises from the tip and the adjacent surface of the coccyx, passes forward, and, surrounding the anus by a thick bundle measuring about one-half an inch in width, is inserted into the perineal centre directly behind the Bulbo-Cavernosus muscle. Some of the marginal fibres are continuous with those of the last-named muscle. In the female the anterior fibres interlace and are lost within the Constrictor Vaginæ muscle.

Function.—To constrict the anus.

Remarks.—The Sphincter Ani belongs to the skin layer of muscles, and in a strict sense cannot have any important association with the skeleton. Leidy, indeed, describes it as arising from the subcutaneous tissue at the end of the coccyx.—A small bursa is sometimes found between the fibres of origin and the coccyx.—It is of importance to ascertain the condition of this muscle in studying many morbid conditions of the anus. It is relaxed in prolapsus of the rectum and in that condition of the parts which is associated with hæmorrhoids. Absolute rest of the anus—a state demanded by the surgeon in his attempts to relieve the distress arising from anal fissure and fistule—is secured by division of the muscular fibres

[1] Journ. de l'Anat. et de la Phys. 1877, 39.

Fig. 82.



A View of the Dissection of the Posterior Perineum of the Male.—A. The sphincter ani (external portion). B. Fibres of the same at the anal orifice. D. Levator ani. E. Gluteus maximus. *a*. Pudic artery. *b*. Inferior hæmorrhoidal artery. *c*. Branch of the sciatic artery. 1. Inferior hemorrhoidal nerve. 2. The superficial perineal nerve. 3. The perineal branch of the fourth sacral nerve. 4. The small sciatic nerve.

surrounding it. The muscle may be ruptured by forcible dilatation from side to side. This procedure will take the place of division under some circumstances, and greatly facilitate operations within the rectum, and it will enable the operator to explore the deeper parts with the hand.

THE LEVATOR ANI.

The Levator Ani is a thin sheet-like muscle lying upon the side of the true pelvis. Its somewhat extended line of origin embraces the horizontal ramus of the pubis between the upper and the lower borders, a small portion of the descending ramus of the pubis, the upper border of the pelvic fascia as it lies between the Obturator Internus muscle (arcus tendinosus), the spine of the ischium, and the lesser sacro-sciatic ligament. The anterior fibres (Levator Prostati) are inserted at the base of the bladder and about the prostate gland. The fibres arising from the pelvic fascia pass downward and inward toward the rectum, with the coats of which they are incorporated near the Sphincter Ani. The posterior fibres arising from the spine of the ischium pass downward and inward, and, approaching one another, are inserted in a raphé extending from the tip and sides of the coccyx to the anus.

Function.—The Levator Ani muscles form a diaphragm across the inferior pelvic strait which supplements in respiration the thoracic diaphragm. When the motions of the last-named structure are impaired, as in the fixation of the lower ribs from a dressing for fractured rib, or in the use of the plaster jacket, the perineum, through the agency of the Levator Ani muscles, is seen to rise in expiration and descend in inspiration. The muscle also aids in the act of defecation and in supporting the pelvic viscera. The membranous surfaces affording origin to its fascicles are rendered tense by the act of squatting, owing to the continuity of these membranes with the lines of origin of the Biceps Flexor Femoris.

Relations.—The Levator Ani muscle is covered below the *arcus tendinosus* by the pelvic fascia, which thus separates it from the peritoneum. Below the fascia separates the muscle from the bladder and rectum in the male, and from the rectum and vagina in the female.

Nerve.—The Levator Ani is supplied by branches of the fourth sacral nerve.

THE ISCHIO-COCCYGEUS.

The Ischio-Coccygeus muscle arises by a broad base from the tip and side of the coccyx and a small portion of the sacrum. It passes outward, its fibres converging as it does so, to be inserted into the spine of the ischium and in part upon the lesser sacro-sciatic ligament. Its anterior border is nearly continuous with the posterior fibres of the Levator Ani.

Functions.—The muscle aids in supporting the pelvic viscera. When both muscles act together they may draw the coccyx slightly forward, and thus lessen the antero-posterior diameter of the inferior strait of the pelvis.

The Ischio-Coccygeus is homologous with the lateral tractor of the tail in the Quadrumana.

Nerve.—The Ischio-Coccygeus is supplied by a branch of the fourth sacral nerve.

2. The Fasciæ of the Perineum.[1]

The fasciæ at the inferior outlet of the pelvis may be studied (1) from above, *i. e.*, from within the pelvis, or (2) from below, *i. e.*, from the skin surface.[2]

(1) *The perineum studied from above.*

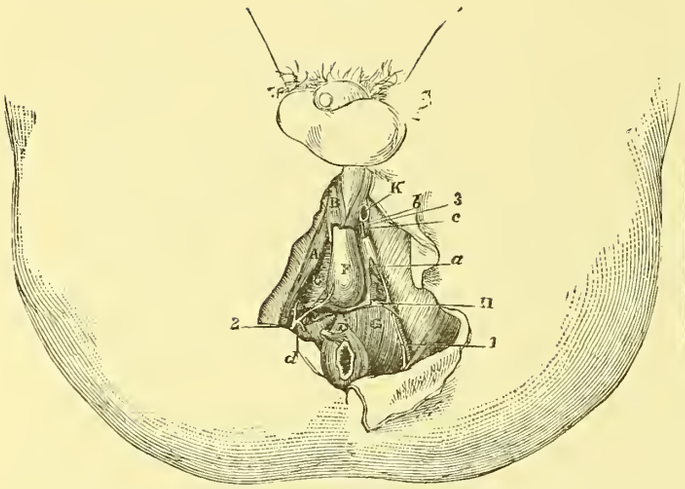
Under this head are included two fasciæ as follows:—

The Obturator Fascia.
The Pelvic Fascia.

[1] For convenience the descriptions of the anus and of the ischio-rectal fossa are included in this section.

[2] This division of the structures at the outlet is shown to be correct by a study of the development of the parts. The pelvic organs are sustained by structures which are common to the abdominal cavity. The skin, the perineal fasciæ and muscles, as opposed to these, are *tegumentary* structures.

Fig. 83.



Deep Dissection of the Perineum.—A. Ischio-cavernosus muscle. B. Bulbo-cavernosus muscle. C. Triangular ligament. D. External portion of sphincter ani muscle. F. Bulbous portion of the urethra. G. Levator ani muscle. H. Transversus perinei profundus. I. Fibres of the same constricting the urethra. K. Section of the crus penis. *a*. Internal pudic artery. *b*. Dorsal artery of the penis. *c*. Artery of the cavernous body. *d*. Deep muscular and urethral branch. 1. Pudic nerve. 2. Muscular branch of the same. 3. Dorsal nerve of the penis.

The *Obturator Fascia* is the proper fascial covering of the Obturator Internus muscle. It lines the wall of the true pelvis, receives the pelvic fascia from above, gives origin to the Levator Ani muscle, and is connected with the lateral margin of the deep perineal fascia and the anterior layer of the triangular ligament.

The Pelvic Fascia.—This membrane forms the subperitoneal fascia of the pelvic organs Like the subperitoneal connective tissue with which it is continuous, the pelvic fascia is loose where it lies near the peritoneum. But as it reaches the lower part of the pelvis, and particularly as it advances to the anterior portion, it becomes thicker, until in the neighborhood of the pubis and the prostate gland it is aponeurotic in structure.

The pelvic fascia is composed of two portions, a parietal and a visceral.

The *parietal portion* or *layer* extends from the iliopectineal line to the origin of the Levator Ani muscle, and from the pubis to the great ischiatic notch. It lies in contact and is incorporated with the obturator fascia as well as with the side of the prostate gland and the rectum. Posteriorly, the pelvic fascia crosses the Pyriformis muscle and is united to the anterior surface of the sacrum by four or five slips. Each interspace between the sacrum and the fascia is occupied by a ganglion of the sympathetic nerve. Below, the fascia is intimately associated with the anterior sacro-coccygeal ligament.

The *visceral portion* or *layer* consists of slips or bands from the parietal layer, which, passing downward, embrace the deep pelvic viscera. The bands are: (*a*) The median and lateral true ligaments of the bladder. These are small slips arising from the parietal layer at the pubis and passing to the lower portion of the bladder. (*b*) The posterior layer of the triangular ligament. This arises from the posterior lip of the pubic arch, and passes thence downward; it is pierced by the membranous portion of the urethra, by the dorsal vein of the penis, by the artery of the penis, and by the dorsal nerve. Bands extending from it along the sides of the prostate gland and the neck of the bladder form the so-called *ligamentum pubo-prostaticum* and the *ligamentum pubo-vesicale*. (*c*) A fascial envelope of the prostate gland continuous with the foregoing, and passing backward to the sides of the bladder and the rectum. This is an important layer, since it embraces the prostatic plexus and is divided in lithotomy. (*d*) A layer (recto-vesical fascia) passing below the prostate gland and extending upward and backward between the rectum and the bladder, separating these viscera and embracing the vesiculæ seminales. According to Denonvilliers, it is continuous with the peritoneum, and forms the *prostatico-peritoneal* ligament. (*e*) A slip from the ischium to the prostate gland. (*f*) A slip from the parietal layer which joins its fellow of the opposite side behind the rectum.

(2) *The perineum studied from beneath.*

The skin of the perineum is marked in the median line by a raphé.

The fasciæ are three in number:—

The Superficial Fascia.
The Fascia Propria.
The Pelvic Fascia.

The Superficial Fascia is composed of two layers: The *first layer* is continuous with the superficial fascia of the trunk and the limbs. It can be traced anteriorly into the dartos of the scrotum, and posteriorly, by means of the fat within its meshes, into the ischio-rectal fossa.

The *second layer*, also called the *deep perineal fascia*, is membranous, and serves as an aponeurosis to the Ischio-Cavernosus, the Bulbo-Cavernosus, and the Transversus Perinei muscles. It is attached to the sides of the inferior outlet of the pelvis as far back as the transverse imaginary line, where it becomes thin, and is lost in the perineal centre. It is here continuous above with the fascia propria. Anteriorly the

second layer is continuous with the sheath of the penis.

The Fascia Propria is a firm unyielding membrane filling in the inferior strait of the pelvis at the pubic arch, and in part continuous posteriorly at the perineal centre with the second layer of the superficial fascia. It is composed of two layers, the anterior and posterior. The *anterior layer* is lost inferiorly on the bulb of the spongy body, and is pierced by the urethra. The *posterior layer* is continuous with the ligamentous bands of the pelvic fascia supporting the prostate gland. The interval between the layers, answering to the thickness of the abutments of the pubic arch, is occupied by the membranous portion of the urethra, the Compressor Urethræ and deep Transversus Perinei muscles, and the glands of Cowper.

The anterior layer of the fascia propria is divided in lithotomy. The *triangular ligament* is a term in general use to signify that portion of the fascia propria supporting the prostate gland and the membranous portion of the urethra.

The *triangular ligament* is a membrane formed in front by a fascial expansion answering to a process of the deep perineal fascia, and behind by the pelvic fascia. The anterior layer unites, behind the Superficial Transverse Perineal muscle, with the deep perineal fascia and with a thin anal fascia extending backward. It would be unwise to attempt to ignore a term that has been in general use so long, although it is necessary to remember that the membrane so named is not a true ligament, and has no distinctive anatomical value.

The pelvic fascia underlies the fascia propria as already described (p. 330, 2d col.).

The posterior perineum embraces—
The Anal Region.
The Ischio-Rectal Fossa.

The Anal Region (ischio-rectal region). The space thus named extends from the coccyx to the posterior border of the Transverse Perinæi Superficiales muscles. On either side it is defined by the median border of the Gluteus Maximus muscle. The region includes the *anus* and the ischio-rectal fossa.

The *Anus* is the outlet of the rectum. It is a closely constricted orifice, lined with mucous membrane within and with integument without. Coarse hairs and a number of sebaceous glands are found about its borders.

The Ischio-Rectal Fossa is defined within by the under surface of the Levator Ani muscle, without by the obturator fascia, and below by the origin of the last-named muscle as well as by the Ischio-Coccygeus muscle.

The fascia of the under surface of the Levator Ani joins the obturator fascia above. Below, it is continuous as a thin layer over the External Sphincter Ani, and is lost anteriorly on the deep perineal fascia. This membrane is the ischio-rectal fascia of some authors. The fossa is filled with fat, which is continuous with that of the buttock.

Remarks.—The perineum is a region within which occur many lesions of practical importance.

The superficial structures may be the seat of *abscess*, which, as a rule, is situated in the anterior perineum only.

The connective tissue beneath the second layer of the perineal fascia and between the two Bulbo-Cavernosi muscles may become the seat of localized inflammation due to traumatic irritation transmitted from the urethra, and often breaks down, forming an *abscess* at a point answering to the perineal raphé. Rarely the pus passes forward to involve the sheath of the penis, but never backward beyond the perineal centre, on account of the union of the second layer of the perineal fascia with the fascia propria.

When pus forms in the space between the two layers of the fascia propria, it meets with less resistance backward and outward than elsewhere, and is apt, therefore, to flow toward and into the posterior portion of the perineum, either superficially at the side of the anus or more deeply seated at the sides of the rectum. One of the most frequent instances in which pus is found occupying this space occurs in *prostatic abscess*. This abscess may thus be sought for by rectal examination, the pus being frequently found directly in front of the anterior wall of the rectum.

In rapidly formed *urinary infiltration*, occurring in advance of the fascia propria, the fluid, guided by the second layer of the perineal fascia, extends forward to the sheath of the penis, and thence to the scrotum and the superficial fascia, by means of which it can be easily conducted to the abdomen. Owing to the union existing between the second layer of the perineal fascia and the fascia propria no infiltration occurs posteriorly about the anus.

If urinary infiltration occurs between the layers of the fascia propria, the urine flows backward, as in the case of the pus in an abscess in the same situation.

Fracture of the pelvis involving the attachment of the fascia propria necessarily lacerates the soft parts lodged between the two layers. Urinary infiltration

into the perineum and *diffuse cellulitis* are in this way liable to occur.

The ischio-rectal fossa is a frequent site of *abscess* and of *fistulous* tracks extending thence from the rectum. In the course of wasting diseases—notably pulmonary consumption—the fat occupying the fossa is absorbed, and the region appears, under the altered condition resulting from the absorption, to be liable to attacks of inflammation and abscess. Extensive infiltration may cause large irregular abscesses to form in the posterior perineum, which, however, as a result of the union existing between the fascia propria and the second layer of the perineal fascia, never involve the anterior perineum.

ON DISPLACEMENTS IN FRACTURE.

After a fracture in any of the movable bones, the action of the muscles connected with the fragments, conjoined to the weight of the limb or adjacent parts, is liable to produce displacements. These are distortions of the axis of the broken bone. The displacement depends, among other things, upon the direction of the fracture. It is more decided in oblique than in transverse fractures, and also holds a direct relation to the development of the muscles attached to the fragments.

The brief account here given of these displacements is not intended to include all the possible forms, but to give those which may be said to be typical. For the unusual forms of displacement, and the explanations of them, the student must consult the elaborate works on surgery.

The Lower Jaw.—In the fracture of the lower jaw at the anterior third of the horizontal portion, the short fragment is elevated, and turned slightly inward by the Temporal, Masseter, and Internal Pterygoid muscles. The larger fragment remains nearly stationary, or is drawn slightly downwards by the depressors of the lower jaw.

When the mental portion is separated by a fracture on each side of the incisorial portion, the middle fragment is drawn forcibly downward by the Genio-Hyoid and Mylo-Hyoid muscles, and, if the detached portion includes the digastric fossa, by the Digastric muscle. The lateral fragments are elevated and drawn inward.

Fracture of the Clavicle.—In all fractures of the clavicle, the weight of the superior extremity tends to pull the outer fragment downward, the displacement being modified by the mobility of the scapula. The most common location of fracture in this bone is at the outer end of the middle third. The weight of the superior extremity here causes the outer fragment of the bone to fall below the level of the inner fragment, which is held in position by the rhomboid ligament and the Subclavius muscle. Some writers believe that the inner fragment may be slightly elevated by the Sterno-Cleido-Mastoid muscle. In addition to its downward traction, the outer fragment is ordinarily drawn in toward the chest, as well as slightly forward, by the Subclavius and Pectoral muscles. It may be drawn slightly backward as well as downward by the muscles holding the scapula and humerus backward, viz., the Serratus Magnus, the Latissimus Dorsi, and possibly by the Rhomboideus.

When the fracture occurs near the sternal end, the outer fragment behaves as in fracture at the middle third. The movements, however, are restricted by the pressure of the first rib immediately beneath and behind the inner end of the outer fragment. The fragment cannot pass backward or downward by reason of the position of this rib, and hence forms a forward projection. The sternal fragment is not deflected.

When the fracture is at the point of the bone answering to the interval between the fibres of the coraco-clavicular ligaments or between the ligaments and the acromial end, little or no displacement occurs. It is limited to an alteration in the direction of the bone by which the natural convexity of this portion of the clavicle is increased.

When the lesion is between the trapezoid ligament and the sterno-clavicular articulation, the displacement of the outer fragment is considerable. When the lesion is to the sternal side of the rhomboid ligament, the acromial fragment alone is ordinarily displaced; since muscular action, the weight of the upper extremity, and the mobility of the scapula all combine to depress the acromial portion, and press

forward its sternal end (the first rib preventing its moving backward), while the sternal fragment remains in the normal position.[1]

The Scapula.—Fracture of the acromion. The Deltoid draws the detached fragment downward and forward.

The coracoid process. The detached portion is drawn downward by the Coraco-Brachialis and the short head of the Biceps muscle, and downward and inward by the Pectoralis Minor. As a result of the severance from the scapula the fragment moves with the humerus in manipulation of the parts.

The Humerus.—The greater tuberosity. The fragment is pulled backward by the Supra-Spinatus, Infra-Spinatus, and Teres Major muscles. The lower fragment is drawn inward by the Subscapularis, and forward by the Pectoralis Major.

The surgical neck. The displacement is confined for the most part to the lower fragment. The sternal portions of the Pectoralis Major, the Latissimus Dorsi, and Teres Major muscles draw the arm toward the chest.

The shaft of the humerus is drawn obliquely outward by the Deltoid, so that the upper fragment tilts toward the axilla; this is possible from the fact that no fibres of this muscle are inserted above the deltoid ridge. Once in this oblique position, the lower fragment is pulled upward, and maintained in this position by the muscles passing from the scapula to the humerus or bones of the forearm, viz., the long head of the Triceps, the Biceps, and the Coraco-Brachialis. The upper fragment moves but little. It may be slightly tilted and elevated. The same kind of displacement, differing in degree only, will be recognized in any fracture of the shaft above the insertion of the deltoid muscle. The displacement is least marked in a moderately oblique fracture, the compact muscular masses about it being well in the embrace of the fascia of the arm, which acts as a bandage, keeping the fragments in position.

When the fracture exists at the lower third of the shaft, the lower fragment ordinarily slips upward behind the upper and toward the inner side, the Triceps being the chief factor in the displacement, the Biceps and Brachialis Anticus assisting.

Fracture of internal epicondyle. The fragment is drawn slightly downward and outward (*i. e.*, toward the forearm) by the flexor mass.

The Radius.—The neck. The forearm being extended, the Biceps muscle would rotate the lower fragment outward and upward. The upper fibres of the Supinator Brevis have been charged (probably on theoretical grounds) with rotating the upper fragment outward. In fact, the fracture is so deeply seated that the displacement (if any) is difficult to make out. The lesion is an exceedingly rare one. When the bone is fractured a short distance below the insertion of the Pronator Radii Teres, the upper fragment is pulled upward by the Biceps muscle at the same time it is rotated inward by the Pronator Teres. The lower fragment is drawn ulna-ward by the Pronator Quadratus, a movement which is aided by the tilting upward of the distal end by the Supinator Longus.

When the bone is fractured at the lower extremity, either at or immediately above the wrist, a characteristic deformity results. The most conspicuous appearance seen is an adduction of the hand, and an undue prominence of the styloid process of the ulna. These signs have a single cause, viz., the extensors and the flexors of the carpus, and the extensors of the thumb (which normally have but slight power in adducting the hand) exerting inordinate action upon the radial border of the hand. The adduction is exaggerated when the internal lateral ligament and the triangular cartilage are ruptured.

In addition to the above, a broad prominence is seen on the dorsum of the forearm a short distance above the wrist, due to the over-riding of the lower fragment upon the upper. In the instances where the fracture has followed a fall upon the hand (including the greater number met with in practice) the lower end of the the upper fragment is violently driven forward into the substance of the Pronator Quadratus.

The Ulna.—The ulna when fractured at or near the centre usually exhibits a slight deformity dependent upon the lower fragment being drawn towards the radius by the Pronator Quadratus, the upper fragment remaining at rest.

When the coracoid process is fractured, the severed tip is drawn upward by the Brachialis Anticus, and flexion of the elbow joint is impaired. Should the fracture have occurred at the base of the process, the ulna is dislocated backward by the traction of the Triceps muscle.

When the olecranon is fractured, the fragment is drawn upward by the Triceps, and is hence above the line of the epi-arthritic processes. Extension of the elbow is partially destroyed, while flexion makes the depression between the olecranon and the shaft pronounced.

[1] R. W. Smith, Dublin Journ. Med. Sci., l., 1870, 8.

Dislocation of Sternum.—The gladiolus is lifted up and carried in advance of the manubrium by the force transmitted to it from the ribs, the manubrium remaining fixed by the first and second ribs. W. Rivington,[1] in describing a lesion of this character, which resulted from a bag of seed falling from a height of forty feet upon the trunk between the shoulders, conceives that the shock of the blow had been received by the six or seven upper dorsal vertebræ, and transmitted by the true ribs to the sternum, driving that bone forward. Owing to the greater mobility and leverage of the five lower true ribs, the gladiolus was acted upon more powerfully than the manubrium, and the result was that the strain fell on the structures uniting the two segments, and that the gladiolus was pressed forward in front of the manubrium.

Fracture of the Sacrum.—When the lesion is transverse and at the lower portion, the lower fragment may be drawn forward by the Gluteus Maximus, Coccygeus, and Sphincter Ani muscles.

The Coccyx.—Similar forces to those above cited will cause the detached portion to be drawn forward.

The Femur.—Fracture of the neck. The lower fragment is drawn upward by the gluteal muscles, aided by the Rectus Femoris and the hamstrings, and inward by the Pectineus, Iliacus Internus, and Psoas Magnus, and the Obturator Internus, aided by the adductor muscles. The eversion of the limb ordinarily resulting from this lesion has been explained on theoretical grounds as the result of the action of the Obturator and Pyriformis muscles, together with the Iliacus and Psoas. The tendency for the foot to turn out is more easily referred to the weight of the foot, and takes place as readily in states of unconsciousness or after death as when the muscular system is active.

Fracture below the trochanter minor. The upper fragment is tilted forward by the Iliacus Internus and Psoas Magnus, and rotated outward by the Gluteal muscles and the external rotators. The lower fragment is drawn upward by the adductor, hamstring, and Rectus Femoris muscles. The eversion of the limb is owing to the same causes as in fracture of the neck.

Fracture in the middle third. The upper fragment, as in the foregoing lesion, lies in advance of the lower, owing to the operation of the same causes, viz., the tilting of the upper fragment by the Iliacus and Psoas. At the same time the Adductor Magnus and Gastrocnemius draw back the lower fragment. Shortening occurs from the traction of the Rectus and hamstring muscles.

Fracture in the lower third of the femur. The upper fragment, as in the other examples of fracture of the shaft, lies in front of the lower, and is drawn slightly inward. The lower fragment is drawn backward toward the ham by the Gastrocnemius muscle. The displacement is slight. Some writers give undue prominence to its amount, while others deny its occurrence under any circumstances. It is generally held that the two Vasti muscles also materially aid in the backward tilting of the fragment.

Congenital Dislocation.—The flexed femur in the fœtus presses upon the posterior and inferior portion of the acetabulum. While in this position, according to Dr. Carnochan,[1] the bone is moved by the muscles which arise from the pelvis and are inserted in or about the trochanter. The Glutei being the more powerful of these muscles have a tendency by undue contraction to drag the head of the femur upon the dorsum of the ilium, thus creating a congenital dislocation of the hip.

The Patella.—In fracture of the patella the upper fragment is drawn upward by the Quadriceps Femoris muscle.

The Tibia.—Fracture of the shaft of the tibia at the superior or middle third prevents displacement of the fragments which vary according to the obliquity and direction of the opposed surfaces. The upper fragment often presents anteriorly and has been described as tilted forward by the Quadriceps Femoris. Such a motion, however, is exceedingly slight, and at best is not enough to account for the position. The shortening of the limb by the Gastrocnemius muscle and the slipping upward of the tip of the oblique surface of the lower fragment behind the upper, thus pushing it forward, is a much more rational explanation. But the lower fragment may be in front and to the outer side of the upper; the fibres of the Gastrocnemius and Soleus muscles being responsible for the traction. The peroneal muscles may draw the foot slightly outward.

In fracture of the fibula with lateral subdislocation of the ankle, the peroneal muscles strongly abduct the foot and tend to evert it.

[1] Med. Chir. Trans., lviii., 106.

[1] Congenital Dislocation of the Hip, New York, 1850.

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